PLAIN TALKS ON MEDICAL ELECTRICITY AND BATTERIES.

BIGELOW.

History
Room
Restricted
RM
871
.B62
1892
HSL

ONDEDITION

GLOSSARY OF ELECTRICAL TERMS USED IN MEDICINE

Collated from Gould's New Medical Dictionary and Hayes' Electro-Therapeutics.

ACCUMULATOR. An apparatus to store electricity—as the Leyden jar and the storage battery.

Agonic Lines. Lines of no variation.

Alternate Currents. Currents in which the direction is changed at regular intervals.

Ampere. The unit of current strength, or the current carried in one second by the force of one volt through a circuit where the resistance is one ohm.

Anelectrotonos. The condition of lessened irritability which exists in that portion of a nerve nearest the positive pole after a current of electricity has been carried through it for some time.

Animal Electricity. Free electricity in the body.

Anions. The atoms which collect around either pole when a compound is decomposed by electricity.

Anode. The "way" by which electricity enters.

Armature. An iron bar attached to the poles of magnets to preserve their magnetism.

Ascending Currents. The current applied by placing the positive electrode upon the periphery of a nerve, and the negative to the nerve center.

BASE. The part of a battery upon which is fastened the coil, posts and switches.

Battery. The electrical apparatus complete, or the cells.

Binding Posts. Clamps for connecting conducting wires with the electrical apparatus.

Break. An opening in the circuit.

CALLAUD BATTERY. Another name for the Gravity Battery.

Carbon. A non-metal occurring in the various forms of diamond, graphite or "black lead," and charcoal.

Catelectrotonus. The state of increased irritability of a nerve near the cathode.

Cathode. The "way" by which electricity leaves a body.

Cautery. See *Galvano-Cautery.*

Cell. The jar, or container, holding the elements and agent producing the electricity.

Centimeter. The hundredth part of a meter, equal to 0.39371 (or about $\frac{2}{5}$) of an English inch.

Central Galvanization. Method of applying a galvanic current to the nerve centers.

Centrifugal Current. A descending current.

Centripetal Current. An ascending current.

Circuit. The path traversed by the current.

Circuit Breaker. An apparatus for interrupting the circuit.

Clamps. Appliance for completing the connection between electrodes and conducting cords.

Closing Contractions. Muscular contractions produced at the instant the circuit is closed.

Coil Induction. Rolls of wire in which the current is induced by the alternate opening and closing of a circuit.

Collecting Plate. The electro-negative element of the pair from which the positive current comes. Called the collecting plate because the hydrogen and other products of decomposition collect about it.

Commutator. A device for changing the direction of the current.

Condenser. An apparatus for accumulating or storing electricity on a small surface.

Conductors. A term applied to the electrodes and cords, by which they are joined to battery.

Conjunctive Wire or Arch. The wire joining the two elements of a galvanic pair, outside the fluid.

Constant Battery. A galvanic battery with two fluid or gravity cells.

Constant Current. A galvanic current from a Constant Battery.

Convection. The discharge of electricity attended by alternate attraction and repulsion of particles of air, and the materials floating in it.

Core. A bundle of soft iron wires used as a magnet in the center of a coil.

Coulomb. The unit of quantity.

Current Breaker. A device for opening and closing the circuit.

Current Reverser. A pole changer.

Current Selector. A device for altering the strength of a current.

DANIELLS CELL. A porous cup containing dilute sulphuric acid immersed in a jar containing a solution of sulphate of copper. The elements are copper and zinc.

Declination. The dip of the needle.

Density. The amount of electricity accumulated on a unit of surface is called "density." The term is also applied to a large quantity passing over a small conductor.

Derivation Wire. A wire connecting two points in a closed circuit.

Derived Current. A current drawn off by a derivation wire from the main current.

Diamagnetic Bodies. Bodies not susceptible of being magnetized.

Dielectric. Insulators across which electric action takes place.

Diffusion of Current. The power of a galvanic current to extend its influence in all directions, that power never being limited to the two electrodes.

Discharger. The instrument which directs the charge from a condenser through an object.

Dynamic Electricity. Electricity in motion.

Dyne. The unit of force—*i. e.* the force which, if it acted for one second on a mass of one gramme, would, if the mass was previously at rest, give it a velocity of one centimeter per second; or, if it was previously in motion in the direction of the force, would in that time alter its velocity by that amount.

Electric Aura. A current of electrified air.

Electric Brush. A wire brush used as an electrode.

Electric Moxa. A burn made on the skin by electricity.

Electrizers. Metal discs of copper and zinc or silver and zinc, applied to the surface of the body and connected with copper wire, exciting with the perspiration a feeble galvanic current.

Electro-Biology. Electrical currents developed in living animal tissues by friction.

Electro-Bioscopy. Testing the muscles by electricity to see if life is extinct.

Electrodes. The instruments fastened to the conducting cords that are used in applying electricity.

Electro-Diagnosis. The diagnosing of disease by means of electricity.

Electrolysis. Separation or analysis of chemical substances by electricity.

Electrolytic. Relating to chemical decomposition produced by electricity.

Electro-magnet. A mass of soft iron surrounded by a coil of wire.

Electro-magnetism. A current from a magneto-electric machine.

Electrometer. Instrument for measuring the strength of the attractions and repulsions between electrified bodies. Also see *Electroscope*.

Electro-Otiatria. Electricity applied for the treatment of diseases of the ear.

Electrophorus. An instrument used to generate small quantities of static electricity.

Electro-Puncture. Electrostixis. The application of electricity by means of needles thrust into the tissues.

Electroscope. Instrument for detecting the presence of static electricity, and determining whether it is positive or negative.

Electro-Tonic. The name given to the changing state of the conducting wires while the current is forming or ceasing.

Electrotonos. The condition of a motor-nerve when a continuous current is passed along it.

Elements. The metals, or carbon and metals, immersed in the battery fluid.

Erg. The unit of work; *i. e.*, it is equal to the work required to move a body through one centimeter against a force of one dyne.

Essential Resistance. The internal resistance within a battery cell.

FARAD. A million micro-farads. The unit of electrical capacity. Practically a capacity sufficient to overcome one coulomb of current having a potential of one volt.

Faradic Current. The current generated in a coil of wire by induction. Also called induced, interrupted or extra current.

Faradic Induction. A current of electricity passing through a wire excites a wave of electricity in a second wire placed near and parallel with it at the instant of opening and closing the circuit. This is faradic induction.

Faradism. The application of induction currents to the treatment of disease.

Faradization. The application of the induced current to a diseased part.

Franklinism. Static electricity employed as a remedial agent.

Frictional Electricity. Electricity set free by friction.

Fustigation, Electric. The application of electricity through a metallic brush.

Galvanic Belt. An appliance for the continuous application of galvanism, consisting of a series of small cells containing various elements.

Galvanic Chain. A series of links composed alternately of zinc and copper, to be worn around the body. The current is generated by the moisture supplied by the perspiration.

Galvanic Circle. This usually refers to a pair of elements immersed in battery fluid and connected outside the fluid. A single circle is one galvanic cell in action. A compound circle is two or more connected together.

Galvanic Current. A current direct from the battery cells.

Galvanic Disks. Disks of two dissimilar metals arranged alternately, between which a communication is established when moistened and placed on the skin.

Galvanic Elements. Two dissimilar metals used in generating a current of electricity.

Galvanic Pessary. An instrument for retaining the uterus in position, and at the same time conducting to it a galvanic current.

Galvanic Poultice. Minute pieces of zinc and copper wrapped in cotton-wool, each pair separated by flannel, all inclosed in a bag, one side of which is made of rubber cloth, the other of cotton. The cotton surface is applied next the skin, and the accumulated perspiration excites galvanic action.

Galvanism. The form of electricity which is generated by chemical action.

Galvano-Cautery. Burning or cauterization of the tissues by an electric current sent through a wire or plate of great resistance (usually platinum).

Galvano-Contractility. Muscular contraction produced by the galvanic current.

Galvanometer. An instrument for measuring the quantity of electricity.

(*See back cover of this book for continuation.*)

WVU – Medical Center Library
History Room RM871 .B62 1892 c.1 WVMH
Plain talks on electricity and batt / Bigelow, Hor
3 0802 000026653 8

History Room
RM
871
.B62
1892

Bigelow, Horatio Ripley
Plain talks on electricit
and batteries

DO NOT CIRCULATE

Digitized by the Internet Archive
in 2009 with funding from
Lyrasis Members and Sloan Foundation

http://www.archive.org/details/plaintalksonelec00bige

PLAIN TALKS

ON

ELECTRICITY AND BATTERIES.

BIGELOW.

TO

A. S. B. AND J. S. B.

PLAIN TALKS

ON

ELECTRICITY AND BATTERIES

WITH THERAPEUTIC INDEX.

FOR GENERAL PRACTITIONERS AND STUDENTS OF MEDICINE.

BY

HORATIO R. BIGELOW, M.D.,

PERMANENT MEMBER OF THE AMERICAN MEDICAL ASSOCIATION; FELLOW OF THE BRITISH GYNÆCOLOGICAL SOCIETY; FELLOW OF THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION; MEMBER OF THE PHILADELPHIA ELECTRO-THERAPEUTIC SOCIETY; MEMBER OF THE ANTHROPOLOGICAL AND BIOLOGICAL SOCIETIES, OF WASHINGTON, D. C.

SECOND EDITION, REVISED.

PHILADELPHIA:
P. BLAKISTON, SON & CO.,
1012 WALNUT STREET.
1892.

Copyright, 1892, by HORATIO R. BIGELOW, M.D.

PRESS OF WM. F. FELL & CO.,
1220-24 SANSOM STREET,
PHILADELPHIA.

PREFACE TO SECOND EDITION.

"It has been computed," said Prof. William Crookes, "that in a single cubic foot of the ether which fills all space, there are locked up ten thousand foot-tons of energy which have hitherto escaped notice. To unlock this boundless store and subdue it to the service of man is a task which awaits the electrician of the future." And again he says: "Another tempting field for research scarcely yet attacked by pioneers awaits exploration. I allude to the mutual action of electricity and life. No sound man of science indorses the assertion that 'electricity is life;' nor can we even venture to speak of life as one of the varieties or manifestations of energy. Nevertheless, electricity has an important influence upon vital phenomena, and is in turn set in action by the living being, animal or vegetable. * * * The light which the study of electricity throws upon a variety of chemical phenomena, witnessed alike in our little laboratories and in the vast laboratories of the earth and the sun, cannot be overlooked. The old electro-chemical theory of Berzelius is superseded and a new and

wider theory is opening out. The facts of electrolysis are by no means either completely detected or co-ordinated. They point to the great probability that electricity is atomic, that an electrical atom is as definite a quantity as a chemical atom. The electrical attraction between two chemical atoms being a trillion times greater than gravitational attraction, is probably the force with which chemistry is most deeply concerned." If electricity be, as it is, the groundwork of chemism, of animal physiology, and if it be of such stupendous power in the industrial arts, are we not logical in anticipating a most brilliant future for electro-therapeutics. Many new cuts of instruments made by the largest manufacturing house in this country are introduced, because personal acquaintance with them has demonstrated their reliability and value.

1716 Chestnut St., Philadelphia.

TABLE OF CONTENTS.

CHAPTER I.

DEFINITIONS.

Electro-Motive Force — Volts — Resistance — Resistance of the Human Body — Ohm's Law — Intensity — Ampère — Tension — Potential — Current — Induction — Dielectrics — Circuit — Polarization — Cataphoresis — Electrolysis — What is Electricity? — Œrsted's Laws — Galvanometer — Physiological Action of Currents.

CHAPTER II.

STATIC ELECTRICITY.

History — The Energy of the Current — How it Penetrates — Number of Oscillations — Leyden Jars — Dielectric Strain — Machines — Holtz's Influence Machine — How to Work It — Insulation — Direct and Indirect Sparks — Static Induced Current — Universal Electrode — Physical Properties of the Franklinic Interrupted Current.

CHAPTER III.

THE GALVANIC CURRENT.

Muscular Contractions — Conditions of Muscular Contraction — Animal Electricity — Volta's Law of Contact — The Pile — Theoretic Conditions of a Perfect Pile — Choice of Cells — Names, Elements and Fluids of Different Batteries — Controller — Meter — Portable Batteries — How to Bring the Battery into Action — Cabinet Batteries — Various Electrodes.

CHAPTER IV.

The Faradic or Induced Current.

Magnetic Induction Currents—Induction Currents Produced by Currents—The Induction Coil—Self Induction—Extra Currents—The Primary and Secondary Coil.

Motor Points.

Dorsal Aspect of Left Arm—Inner Aspect of Left Arm—Outer Aspect of Left Leg—Posterior Aspect of Left Leg and Thigh—Anterior Aspect of Left Thigh—Motor Points of Face and Neck—Apostoli's Bi polar Uterine Faradization—Electrode in Position.

Therapeutic Index, Alphabetically Arranged, with explanations of the different forms of Galvanization and Faradization.

PLAIN TALKS ON ELECTRICITY AND BATTERIES.

CHAPTER I.

DEFINITIONS.

Electro-motor Force is that which sets electricity in motion, or the difference of potential between two points, the transfer always taking place from the higher to the lower. This "electro-motive force," or that which tends to move electricity, must not be confounded with *electric "force,"* or that force with which electricity tends to move matter. "Just as in water-pipes a *difference* of *level* produces a *pressure*, and the pressure produces a *flow* so soon as the tap is turned on, so *difference of potential* produces *electro-motive force*, and electro-motive force sets up a *current* so soon as a connection is made for the electricity to flow through." The symbol used is E. M. F. Electro-motive force is measured in

Volts.—One volt will send a quantity of elec-

tricity, known as a *coulomb*, through one *ohm* of resistance.

Resistance.—This is the measure of the value of the obstruction to the free transmission of electricity. It is the *inverse of its conductibility*. In fifty healthy people Wolfenden found the resistance to be 4000 and 5000 ohms with a current of 15 volts. In eighteen cases of Grave's disease he found the resistance to vary between 500 and 1500 ohms. There is also a resistance, which is variable, but ought not to exceed 1.15 or 2. ohms, within the cell itself. Then the connecting wire and the electrode also offer some obstruction. The measure of resistance is the

Ohm.—And *Ohm's* law is that *the current in any conductor is equal to the electro-motive force between its ends divided by its resistance.* $C = \frac{E}{R}$, or 1 ampère $= \frac{1 \text{ volt}}{1 \text{ ohm}}$.

Intensity.—The intensity of a current is the same in all points of the circuit, and is really the quantity of electricity passing any part of the circuit in a second. Its measure is the

Ampère, but for medical purposes we use the thousandth part of it, which is called a *milliampère*.

Tension.—This is the property of electricity to give effects similar to those of static electricity. It is that which gives impulse to the electric fluid. This term is so often misused that it should be

dropped altogether. It has even been confounded with potential and electric force.

Potential.—This is the measure of the work done, and is expressed in centimetres, grammes. The standard of reference is the earth, whose potential is supposed to be zero. The *potential* characterizes the electric condition of a body, just as *temperature* does its *heat*. *The potential at any point is the work that must be spent upon a unit of positive electricity in bringing it up to that point from an infinite distance.* Since the surface of a conductor must be everywhere at the same potential, it is on this account called an *equipotential surface.*

Current.—The passage of electricity through a body constitutes a *current.*

Induction.—If we rub a glass ball with silk to electrify it, and hold it near to a body that has not been electrified, the conductor itself, which has not been rubbed, will behave at its two ends as an electrified body. The end nearest the ball will be charged negatively, and the farthest end will be positive. A positive charge attracts negative and repels positive, and this influence may be exerted at a distance from the body. This is induction or influence. Faraday discovered that the *air* plays a most important rôle in induction. So we may say that induction is the power of an electrified body to act through the molecules of the air on

another body decomposing its fluid and attracting its opposite electricity.

Dielectrics.—The property of certain substances to permit an inductive electric influence to act across or through them, led Faraday to call such substances Dielectrics. "All dielectrics are insulators, but equally good insulators are not necessarily equally good dielectrics." Glass is a better dielectric than ebonite, or paraffin, or air.

Circuit.—This is the complete path through which the current flows from its source back again.

Polarization.—A battery is said to be polarized when a film of hydrogen bubbles is found sticking to the copper pole, thus destroying the effective amount of surface of the copper plate, so that the strength of the current, after a few seconds, falls off materially. The effects of polarization are: that it weakens the current by the increased resistance which it offers to its flow, and that it weakens the current by setting up an opposing *electro-motive force*, since hydrogen, being almost as oxidizable a substance as zinc, produces a difference of potential, which would tend to start a current in the opposite direction to the true current.

Cataphoresis.—The method of introducing medicinal agents into the system by the galvanic current.

Electrolysis is the action of a current when

passing through a liquid of decomposing it, so that the *metal* will go to the *negative* electrode and the *radical* to the *positive*. Faraday called the *positive* plate the *anode*, and the negative plate the *kathode*. The solution through which the current flowed he called an *electrolyte*. Upon animal tissue the electrolytic effects are very marked. The alkalies go to the negative pole and the acids to the positive. Hence the necessity of using a *platinum*, *gold*, or *carbon electrode* in the positive pole when a concentrated current is being used.

Electricity.—This is a form of energy, just as heat is. When a bar of iron, one end of which is resting upon a block of ice, is heated, a change takes place; an energy is transmitted along the bar, which has no exact definition. Magnetism, which may possibly be a mere circular current of electricity of the ultimate molecule, is another form of energy, and as light is also an energy due to molecular change of the ether, so we may correlate all of these forms of energies. The conservation of force teaches us that these energies may appear under other correlate forms, so that a motion once originated is never lost. If we can imagine a current started in a conductor frozen to 273° Centigrade minus, where molecular movement is at rest, such a current would be perpetual, because there would be no resistance. Gravity is another instance,

and this illustrates resistance perfectly. The falling body develops an energy peculiar to itself, movement, which may be transformed into heat. The earth develops energy in drawing the body to itself. If the book rest on the table, the earth still endeavors to attract it, and the book also endeavors to fall to the earth, but there is an interposed resistance, the table, and as a result we have pressure. Only by the supposition of a surrounding ether can we account for induction, magnetic fields and optical phenomena. All of Oersted's laws, perfected and worked out by Faraday, out of which grew the telegraph, telephone, phonograph and dynamo machines, are based upon these questions of inductive currents. Oersted found that if a current of electricity were passed *over* a magnetic needle, the needle was deflected in a certain direction, and if the current of electricity was passed under the needle it was deflected in another direction. He also found that a magnet could induce a current by induction in another current; that a current could induce magnetic action in a bar of iron, and that one current could influence another. This is the whole principle of dynamos, which are fashioned upon the knowledge we have that, when a bar of iron is wrapped about with wire and a current started through it, not only is the iron magnetized, but the action of the magnetized iron greatly

intensifies the current. So arose Gramme's rings and the armature.

Galvanometer.—When a magnetic needle is suspended in a ring through which a current flows, every part of the ring carrying the current is trying to drive the north pole of the needle through the middle of the ring in one direction, and the south pole in the other direction, so that the compass needle in the centre of the ring would have a strong tendency to set with its length along the axis of the ring. Now if we have a coil of 1000 turns of wire, the current will only require the one-thousandth of the strength to produce the same effect. This is the principle of the galvanometer for measuring small currents. "If we give the wire a turn around the compass needle so that the current flows over the needle from south to north, and under it from north to south, the two actions reinforce each other, both turning the north end of the needle to the west. If we repeat the operation by making a number of turns of wire surround the compass needle, we multiply the effect, provided we take care that successive turns of wire are insulated from each other, which is done by covering the wire with cotton, or better, with silk, or even gutta percha or India rubber. By this device the current must go round each turn completely."

"**Physiological Actions.**—Currents of elec-

tricity passed through the limbs affect the nerves with certain painful sensations, and cause the muscles to undergo involuntary contractions. The sudden rush of even a small charge of electricity from a Leyden jar charged to a high potential, or from an induction coil, gives a sharp and painful *shock* to the system. The current from a few strong Grove's cells, conveyed through the body by grasping the terminals with moistened hands, gives a very different kind of sensation, not at all agreeable, of a prickling in the joints of the arms and shoulders, but not producing any spasmodic contractions, except it be in nervous or weakly persons, at the sudden making or breaking of the circuit. The difference between the two cases lies in the fact that the tissues of the body offer a very considerable resistance, and that the difference of potential in the former case may be many thousands of volts; hence, though the actual quantity stored up in the Leyden jar is very small, its very high E. M. F. enables it at once to overcome the resistance. The battery, although it might, when working through a good conductor, afford in one second a thousand times as much electricity, cannot, when working through the high resistance of the body, transmit more than a small fraction, owing to its limited E. M. F.

"After the discovery of the *shock* of the Leyden

jar by Cunæus in 1745 many experiments were tried. Louis XV of France caused an electric shock from a battery of Leyden jars to be administered to 700 Carthusian monks joined hand in hand, with prodigious effect. Franklin killed a turkey by a shock from a Leyden jar.

"In 1752 Sulzer remarked that 'if you join two pieces of lead and silver, and then lay them upon the tongue, you will notice a certain *taste* resembling that of green vitriol, while each piece apart produces no such sensation.' This galvanic taste, not then suspected to have any connection with electricity, may be experienced by placing a silver coin on the tongue and a steel pen under it, the edges of them being then brought into metallic contact. The same taste is noticed if the two wires from the poles of a voltaic cell are placed in contact with the tongue.

"Ritter discovered that a feeble current transmitted through the eyeball produces the sensation as of a bright *flash of light* by its sudden stimulation of the optic nerve. A stronger current transmitted by means of moistened conductors attached to the battery terminals gave a sensation of blue and green *colors* in flowing between the forehead and the hand. Helmholtz, repeating this experiment, observed only a wild rush of color. Dr. Hunter saw flashes of light when a piece of metal

placed under the tongue was touched against another which touched the moist tissues of the eye. Volta and Ritter heard musical sounds when a current was passed through the ears; and Humboldt found a sensation to be produced in the organs of smell when a current was passed from the nostril to the soft palate. Each of the specialized senses can be stimulated into activity by the current. Man possesses no specialized sense for the perception of electrical forces, as he does for light and for sound; but there is no reason for denying the possibility that some of the lower creatures may be endowed with a special electrical sense."—(*Sylvanus Thompson.*)

CHAPTER II.

STATIC ELECTRICITY.

Known also as frictional or *Franklinic*.

At least six centuries B. C., it was noticed that amber when rubbed with silk attracted light bodies. Somewhat later the same properties were found to belong to sulphur, sealing wax and glass.

We have two kinds of electricity: that which is generated by rubbing glass with silk, which we call *vitreous*, and that from rubbing sealing wax with flannel, which is known as *resinous*. Bodies charged with the same electricity repel each other.

For convenience alone, we regard electricity as a fluid, of which there are two kinds, positive and negative.

Now when we rub the sealing wax with a bit of flannel, we do not produce negative electricity *alone*, since the flannel becomes positive, while the sealing wax is negative.

All static machines have for their end the separation of these two electricities, and are composed of two parts, one for generating electricity and the other for collecting it.

Biot, Cavendish and others showed that electricity at rest, or static electricity, resides in the surface of bodies which are charged with it, so that some authorities were led to believe that frictional electricity never penetrated beneath the skin, nor produced directly any effect upon the deeper tissues. We are indebted to Dr. W. J. Morton, of New York, for what seems to me to be a very thorough refutation of these opinions.

He demonstrates that a single spark represents a muscular energy expended equal to raising 1 pound 1 foot per second, and he goes on to say: "But I can easily give, say, 5 sparks per second. The muscle therefore raises [referring to one of his experiments.—ED.] 5 pounds per second, and to raise 550 pounds (the unit of horse-power) will require 110 seconds, or about 2 minutes. The actual work, therefore, capable of being accomplished by the muscle under the stimulus of the spark is at the rate of 1 horse-power every 2 minutes, or ½ horse-power per minute. . . .

"That frictional electricity, when static, resides upon the surface is one way of making the statement. To avoid argument we will admit it. We will say, then, that the person sitting upon the insulated stool receives the electric charge upon the surface.

"But while bringing forward one fundamental law

of electricity, Dr. Starr ignores another one equally fundamental, which is that the potential at all points of a conductor on which electricity is at rest must be uniform; if it were not, there would be a flow between the two unequal potentials until it became uniform; hence the potential inside a conductor has the same value as at any point on the surface.

"It follows that at the moment of discharge (spark) the equalizing of the potentials proceeds from and to all parts of the conductor (human body), inside and outside, and we here have the current which produces the effects on nerve and muscle. And the conducting power of the charged conductor is proportional, not to the surface, but to the mass of the conductor, for a solid rod of a given diameter will convey a current which would melt a thin tube of the same diameter.

"Given, then, a surface charge upon the body, and the first spark changes the entire situation. The spark is a current, but it is only the air part of the current—the evidence of the breaking down of the strain in the fluid dielectric; the remaining continuity of the current is *in* the patient's body, not *on* it (for the potential is uniform), in the chain going from the platform to the machine, and so on up to the initial electro-motive force of the Holtz machine, and around again in a closed circuit to the ball electrode which gave the spark. The conditions

do not vary essentially from those existing in a galvanic cell or a storage battery. When we close the circuit we get the current, and it is this current which, localized by an electrode, traverses the human body at any desired point—a current of, say, 50,000 volts as against 1 volt of a Daniell's cell—put to work to overcome the resistance of, say, 2500 ohms of the body; a resistance so trivial in comparison with the voltage or pressure that it may be disregarded entirely—a current oscillating (alternating) 100,000 to 1,000,000 times per second, compensating, as regards its physiological activity, for its loss in quantity, by its enormous electro-motive force and by its exceeding rapidity. The wonder would be that nerve and muscle and all tissues should not be stimulated. The fact is that they are. And Dr. Starr's entire structure, based upon static charge, falls to the ground in the light of the discharge and its accompanying current and physiological effects, and he should alter his apparently thoughtless dictum and write, 'frictional electricity, as commonly administered, penetrates beneath the skin and produces directly effects upon the deeper tissues.'

"In conclusion, to leave facts and venture a single opinion, I believe that no form of electricity 'penetrates' more deeply than the static; and, premising a powerful machine, a powerful spark, a conservative expectation as to results, a fair comparison

with galvanism and faradism, an intelligent selection of cases, and a fair amount of skill in administration, I believe that no form of electricity equals it in curative effect."

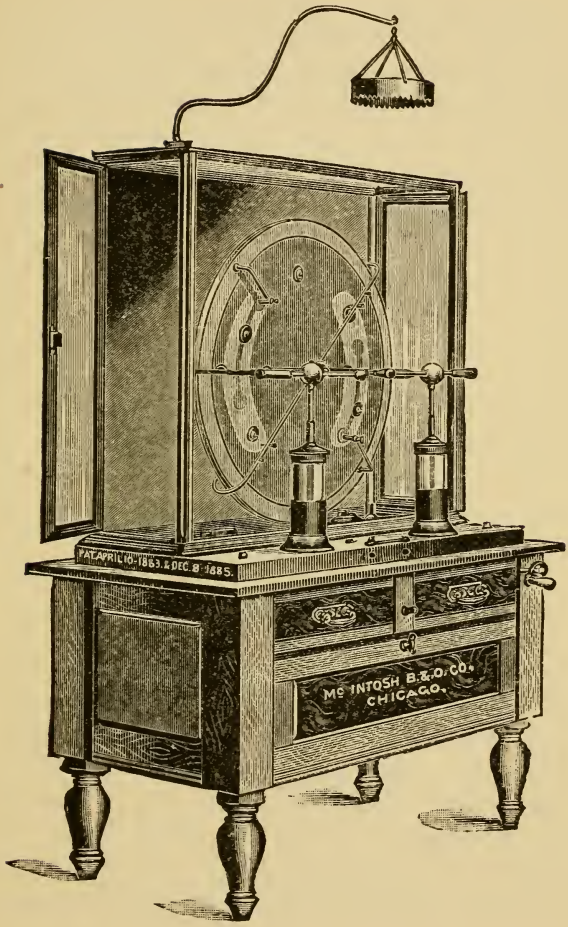
I give this long extract from Dr. Morton, not only because he is a recognized authority, but because, too, I feel sure that static electricity in the near future will play a most important rôle in electro-therapeutics. With static induction, which will be described farther on, we have a current of much greater value and wider scope than that of the induction coil, known also as Faradic, and I could wish that every reader of this book should also read a very remarkable article, published by Dr. Morton in the New York *Medical Record*, January 24th, 1891, on the "Franklinic Interrupted Current."

Leyden Jars.—"These are condensers, consisting simply of a glass jar, covered inside and outside, except near the neck, with tin-foil. On top of the jar is a brass knob in metallic communication with the inside coating, but insulated from the outside metal by means of a wooden stopper, through which the knob passes." By condenser we understand, simply, a holder of electricity. To charge the jar, the knob is held to the prime conductor of an electrical machine, the outer coating being either held in the hand or connected to "earth" by wire or chain. When a + charge of electricity is imparted

thus to the inner coating, it acts inductively on the outer coating, attracting a — charge into the face of the outer coating nearest the glass, and repelling a + charge to the outside of the outer coating, and thence through the hand or wire to earth. After a few moments, the jar will have acquired its full charge, the outer coating being — and the inner +. Properly cared for, the jar will retain its charge for days. By establishing a circuit between the outer and the inner coating, the jar will be discharged, and a bright spark will pass between the conductors.

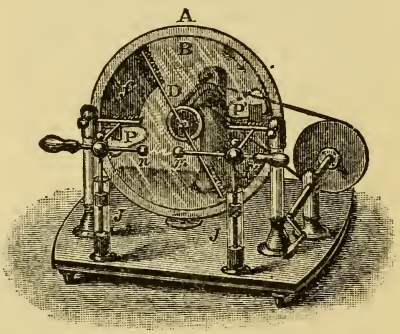
Dielectric Strain.—This hypothesis, enunciated by Faraday, is, *that electric force acts across space in consequence of the transmission of stresses and strains in the medium with which space is filled.* All dielectrics across which inductive actions are at work, are thereby *strained;* that is, there is an alteration of form or volume due to the application of a stress, and it is believed that electrical phenomena are due to stresses and strains in the so-called "ether," the thin medium pervading all matter and space, whose highly elastic constitution enables it to convey to us the vibrations of light, though it is millions of times less dense than the air. The glass between the two coatings of tin-foil in the Leyden jar is actually strained or squeezed between the attracting charges of electricity.

FIG. 1.



Holtz's Influence Machine.—The action of this machine is not altogether easy to grasp, though in reality simple enough when carefully explained. The machine in its latest form consists (Fig. 2) of two plates, one, A, fixed by its edges; the other, B, mounted on an axis, and requiring to be rotated at a high speed by a band and driving pulley.

Fig. 2.



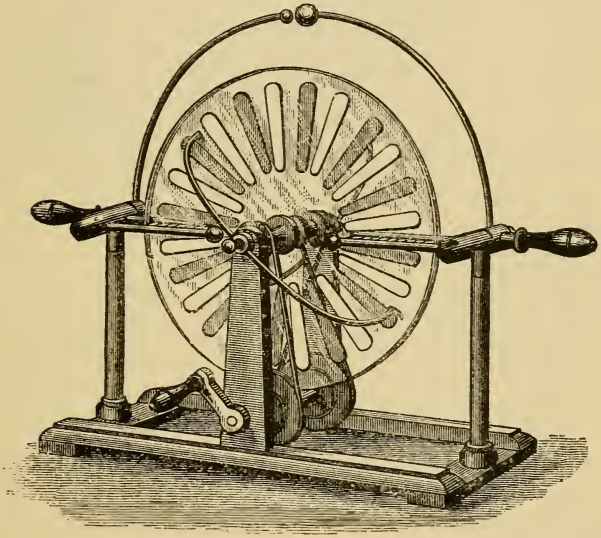
There are two holes or windows, P and P′, cut at opposite points of the fixed plate. Two pieces of varnished paper, *f* and *f′*, are fastened to the plate above the window on the left and below the one on the right. These pieces of paper or *armatures* are upon the side of the fixed plate away from the movable disc, or, as we may say, upon the back of the plate. They are provided with narrow tongues

which project forward through the windows toward the movable disc, which they nearly touch with their protruding points. The disc must rotate in the opposite direction to that in which these tongues point. On the front side of the moving disc, and opposite the forward edges of the two armatures, stands an oblique metal conductor, D, which need not be insulated. It has metal *combs* or spikes projecting toward the disc. On the right and left, supported on insulating holders, are two horizontal metal combs, joined to two metal rods terminated with brass balls, *m*, *n*, which in this form of machine merely constitute a discharging apparatus, and are not concerned in the action of the machine. In some forms of Holtz's machine there is no diagonal conductor, D; and as the discharging apparatus has then to serve both functions, the balls, *m*, *n*, must in these forms of machine touch one another before the machine will charge itself. To work the machine a small initial charge must be given by an electrophorus, or by a rubbed glass rod, to one of the two armatures. The disc is then rapidly rotated; and it is found that after a few turns the exertion required to keep up the rotation increases greatly; at the same moment pale-blue brushes of light are seen to issue from the points, and, on separating the brass balls, a torrent of brilliant sparks darts across the intervening space.

The action of the machine is as follows: Suppose a small + charge to be imparted at the outset to the right armature, *f'*; this charge acts inductively across the intervening glass and air upon the comb at the lower end of the diagonal conductor D, repels electricity through D, leaving the lower points negatively electrified. These discharge negatively electrified air upon the front surface of the movable disc, while the repelled + charge passes up along D, and is discharged through the upper comb upon the front face of the movable disc. Here it acts inductively upon the paper armature *f*, causing that part which is opposite the comb to be negatively charged, and repelling a + charge into its farthest part, viz., into the tongue, which slowly discharges a + charge upon the back of the moving disc. If now the disc be turned around, this + charge on the back comes over, in the direction indicated by the arrow, from the left to the right side; and, when it gets opposite the right tongue, is discharged into the armature *f'*, increasing its charge, and thereby helps that armature to act still more strongly than before. Meantime the — charge, which we saw had been induced in the left armature *f*, has in turn reacted on the upper comb, causing it to emit more powerfully than before a + charge from its points, and drawing electricity through the diagonal rod. The

combs at the two ends of this rod, therefore, both emit electrified streams of air, the upper one charging the upper portion of the front of the rotating disc positively, the lower one charging the lower

FIG. 3.



portion of the disc negatively. The back of the rotating disc is at the same time similarly charged; and the charges carried round on the back surface serve to increase the charges on the two armatures. Hence a very small initial charge is speedily raised

to a maximum, the limit being reached when the electrification of the armatures is so great that the leakage of electricity at their surface equals the gain by induction and convection. The charges let off by the spikes of the diagonal conductor upon the front surface of the moving disc are carried round and discharged into the right and left conductors of the discharging apparatus, by means of the horizontal combs which collect the charges. Two small Leyden jars are usually added to increase the density of the sparks that pass between *m* and *n*.

In some recent Holtz machines, a number of rotating discs fixed upon one common axis are employed, and the whole is enclosed in a glass case to prevent access of damp. A small disc of ebonite is now usually fixed to the axis, and provided with a rubber in order to keep up the initial charge. Holtz has lately constructed a machine with thirty-two plates.

Mascart has shown the interesting fact that the Holtz machine is *reversible* in its action; that is to say, that if a continuous supply of the two electricities (furnished by another machine) be communicated to the armatures, the movable plate will be thereby set in rotation, and will turn in an opposite sense.

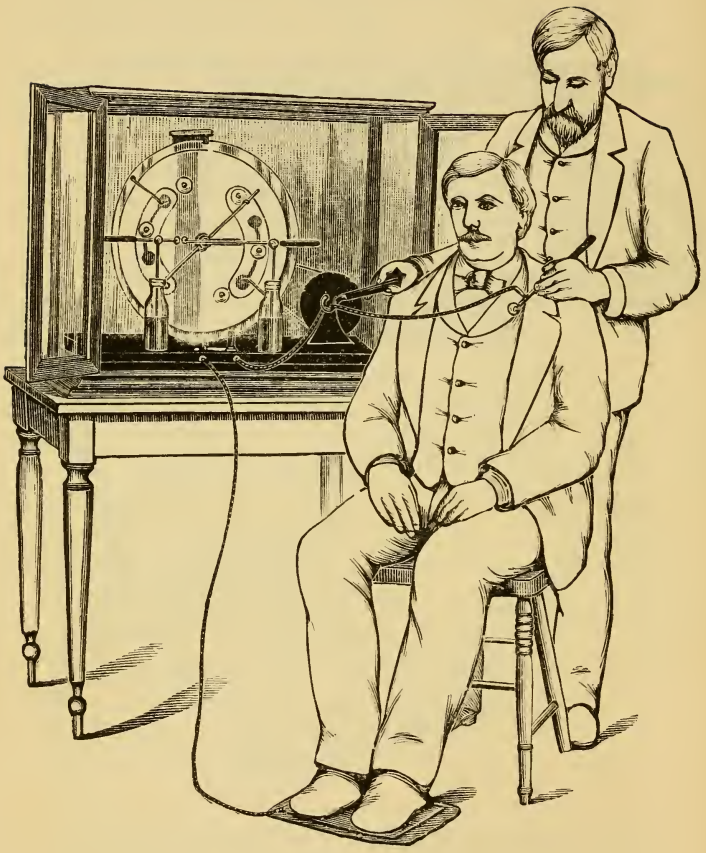
Righi has shown that a Holtz machine can yield a continuous current like a voltaic battery, the

strength of the current being nearly proportional

FIG. 4.

to the velocity of rotation. It was found that the electro-motive force of a machine was equal to that

FIG. 5.



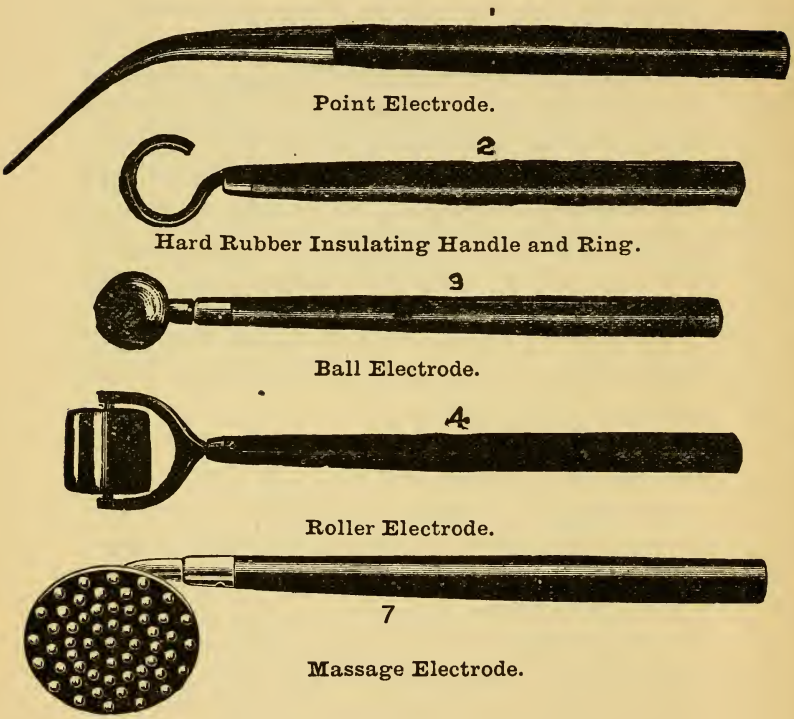
of 52,000 Daniell's cells, or nearly 53,000 volts, at all speeds. The resistance, when the machine made 120 revolutions per minute, was 2180 million ohms; but only 646 million ohms when making 450 revolutions per minute.

The machine represented in Fig. 1, made by the McIntosh Optical and Battery Company, of Chicago, is the Töpler-Atkinson form, and is altogether the most satisfactory one that I know of. The workmanship is superb. This machine is always reliable, as atmospheric conditions do not influence it readily. By a simple movement of the switch the operator passes to the induced current, which is regulated in intensity by the distance between the discharging rods. It is an ideal machine that always gives satisfaction.

Static Insulation.—The patient is placed upon the insulated platform, and his body, or the stool upon which he sits, connected with the machine by a chain. The chain must not touch the floor. The other pole of the machine is then grounded by attaching the chain to the gas or water fixture, or simply allowing the free end to rest upon the uncarpeted floor. The poles of the machine are now separated and the machine put in rapid motion. The patient thus becomes charged with static electricity.

Indirect and Direct Sparks.—If the patient remains seated upon the platform, charged as before,

FIG. 6.



Point Electrode.

Hard Rubber Insulating Handle and Ring.

Ball Electrode.

Roller Electrode.

Massage Electrode.

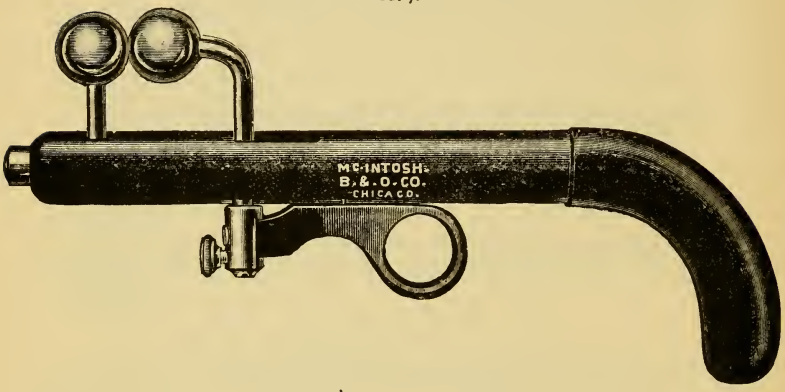
and a metal ball electrode, attached to a chain, is connected with a gas or water fixture, sparks will

be drawn from the part of the body to which the ball is approached. This is termed the "indirect" spark. The "direct spark" is produced by connecting the electrode directly to the grounding chain, so as to place the patient in a short circuit.

Static Induced Current.—For this current the electrodes and conducting cords must be especially constructed: the metal within the sponge, if a plate, should be rolled back on itself at its edges so as to present a rounded peripheral contour, or, better still, it should be a ball of about one inch in diameter; the handles of the electrodes should be long, and made of ebonite; the conducting cord should consist of a thick strand of fine wire, well insulated by gutta percha. These precautions are necessary, owing to the great "tension" of the current and its consequent disposition to break down insulating barriers, which, in the case of ordinary currents, would suffice to confine them to their proper conductors. To use the current, bring the discharging rods (Fig. 5) of the machine into contact, throw the switch off, and attach the conducting cord as in Fig. 5. The strength of the current is increased by separating the discharging rods. The patient need not be insulated. If, now, the wet electrodes be grasped, the machine set in motion, and the discharging rods be separated a very small fraction of an inch, the current will be felt,

and may be graduated to any strength desired or bearable, and may be localized in its action internally or externally in the usual manner. By use of the insulated electrode devised by Dr. Morton, this current can be made of the greatest possible use in gynæcological work. Dr. Morton believes that this current penetrates as deeply into the human body as the galvanic current.

Fig. 7.



MORTON'S PISTOL ELECTRODE.

Electrode.—The pistol electrode (shown in Fig. 7 and invented by Dr. Morton) is suitable for the application of this current, or for any static current. The physician may, by a simple motion of the finger in operating the circuit-breaker, change his treatment from sparks to current, and *vice versâ*,

and because a great variety of terminals may be attached to it, adapting it to the customary forms of application desired for galvanism or Faradism. It will be recognized as a great convenience, in a single sitting, to turn at once from the spark treatment to an agreeable, regulatable, efficient current for use about the face and neck, and wherever else desired to uncover the skin, or to introduce, by adding a suitable terminal electrode, within a canal or cavity.

Physical Properties of the Franklinic Interrupted Current.—Dr. Morton says: "Computing the spark interruption to be, at the least, two hundred per second, and the oscillations of each spark to be one hundred millions per second, we have a current giving twenty billions alternations per second. Vast as such a number may seem to our minds, familiar with two hundred vibrations per second, it pales before the desideratum expressed by Professor Elihu Thompson, the great authority on the properties of alternating currents, who said, in a recent lecture, 'what is needed is a machine having an alternating current making five hundred trillions of vibrations per second, which would produce many wonderful results.' If, then, I were to be asked how the Franklinic current differs from the ordinary Faradic coil, I should reply that this one difference of rate of alternations alone placed the two far apart. But it may be urged, the cur-

rent of the induction coil is far greater than that of the influence machine in quantity. This is, of course, true. But at this point, in favor of the Franklinic interrupted, comes in the element of time. 'The motor nerve,' says DuBois Reymond, 'is not stimulated by the absolute density of the current density at any given moment, but by variations from one instant to the other, and the effect produced by these rapid changes increases with their rapidity and their greatness in a given time.' Thus, in the great rapidity of the alternating (oscillating) currents of the spark discharge, particularly in rapid series, as in the Franklinic interrupted, we find the reason, despite smallness in quantity, for accomplishing work in producing nerve- and muscle-stimulation equal at least to the comparatively slow discharge of the interrupted galvanic, or the slowly oscillating induction coil. The difference may be compared to a bullet shot from a rifle, or the same bullet gently rolled across the floor."

CHAPTER III.

THE GALVANIC CURRENT.

Muscular Contractions.—In 1678, Swammerdam showed to the Grand Duke of Tuscany that when a portion of muscle of a frog's leg hanging by a thread of nerve bound with silver wire was held over a copper support, so that both nerve and wire touched the copper, the muscle immediately contracted. More than a century later, Galvani's attention was drawn to the subject by his observation of spasmodic contractions in the legs of freshly-killed frogs under the influence of the "return-shock" experienced every time a neighboring electric machine was discharged. Unaware of Swammerdam's experiment, he discovered in 1786 the fact that, when nerve and muscle touch two dissimilar metals in contact with one another, a contraction of the muscle takes place. After the frog has been killed the hind limbs are detached and skinned; the crural nerves and their attachments to the lumbar vertebræ remaining. For some hours after death, the limbs retain their contractile power. The frog's limbs thus prepared form an excessively delicate galvano-

scope; with them, for example, the excessively delicate induction-currents of the telephone can be shown, though the most sensitive galvanometers barely detect them. Galvani and Aldini proved that other creatures undergo like effects. With a pile of 100 pairs Aldini experimented on newly-killed sheep, oxen, and rabbits, and found them to suffer spasmodic muscular contractions. Humboldt proved the same on fishes; and Zanotti, by sending a current through a newly-killed grasshopper, caused it to emit its familiar chirp. Aldini, and, later, Dr. Ure, of Glasgow, experimented on the bodies of executed criminals, with a success terrible to behold. The facial muscles underwent horrible contortions, and the chest heaved with the contraction of the diaphragm. This has suggested the employment of electric currents as an adjunct in reviving persons who have been drowned, the contraction of the muscles of the chest serving to start respiration into activity. The small muscles attached to the roots of the hairs of the head appear to be markedly sensitive to electrical conditions from the readiness with which electrification causes the hair to stand on end.

Conditions of Muscular Contraction.—To produce muscular contraction the current must traverse a portion of the nerve longitudinally. In a freshly prepared frog the current causes a contraction only

momentarily when the circuit is made or broken. A rapidly interrupted current will induce a second contraction before the first has had time to pass off, and the muscle may exhibit thus a continuous contraction resembling *tetanus*. The prepared frog after a short time becomes less sensitive, and a "direct" current (that is to say, one passing along the nerve in the direction from the brain to the muscle) only produces an effect when circuit is made, while an "inverse" current only produces an effect when the circuit is broken. Matteucci, who observed this, also discovered, by experiments on living animals, that there is a distinction between the conductivity of sensory and motor nerves,—a "direct" current affecting the motor nerves on making the circuit, and the sensory nerves on breaking it; while an "inverse" current produced inverse results. Little is, however, yet known of the conditions of conductivity of the matter of the nerves; they conduct better than muscular tissue, cartilage, or bone; but, of all substances in the body, the blood conducts best. Powerful currents, doubtless, electrolyze the blood to some extent, coagulating it and the albumin it contains. The power of *contracting* under the influence of the current, appears to be a distinguishing property of *protoplasm* wherever it occurs. The amœba, the most structureless of organisms, suffers contractions. Ritter

discovered that the *sensitive plant* shuts up when electrified, and Burdon Sanderson has shown that this property extends to other vegetables, being exhibited by the *carnivorous plant*, the Dionæa, or Venus's Fly Trap.

Animal Electricity.—Although in his later writings at least, Galvani admitted that the electricity thus operating arose from the metals employed, he insisted on the existence of an *animal electricity* resident in the muscular and nervous structures. He showed that contractions could be produced without using any metals at all by merely touching a nerve at two different points along its length with a morsel of muscle cut from a living frog; and that a conductor of one metal when joining a nerve to a muscle also sufficed to cause contraction in the latter. Galvani and Aldini regarded these facts as a disproof of Volta's contact theory. Volta regarded them as proving that the contact between nerve and muscle itself produced (as in the case of two dissimilar metals) opposite electrical conditions. Nobili, later, showed that when the nerve and the muscle of the frog were respectively connected by a water-contact with the terminals of a delicate galvanometer, a *current* is produced which lasts several hours: he even arranged a number of frogs' legs in series, like the cells of a battery, and thus increased the cur-

rent. Matteucci showed that through the muscle alone there is an electro-motive force. Du Bois Reymond has shown that if the end of a muscle be cut across, the *ends* of the muscular fibres of the transverse section are negative, and the *sides* of the muscular fibres are positive, and that this difference of potential will produce a current even while the muscle is at rest. To demonstrate this he employed a fine astatic galvanometer with 20,000 turns of wire in its coils; and to obviate errors arising from the contact of the ends of the wires with the tissues *unpolarizable electrodes* were used, made by plunging terminal zinc points into a saturated solution of sulphate of zinc, contained in a fine glass tube, the end of which was stopped with a porous plug of moistened china clay. The contraction of muscles also produces currents. These Du Bois Reymond obtained from his own muscles by dipping the tips of his fore-fingers into two cups of salt water communicating with the galvanometer terminals. A sudden contraction of the muscles of either arm produced a current from the contracted toward the uncontracted muscles. Dewar has shown that when light falls upon the retina of the eye an electric current is set up in the optic nerve."—*Silvanus Thompson.*

Volta's Law of Contact.—"The contact of two metals and, most generally, of any two heterogene-

ous bodies, suffices to establish between these bodies a difference of potential. This difference depends upon the nature of the bodies and upon their temperature, etc."

The Pile.—Take a plate of copper, and a plate of zinc. Immerse them in acidulated water, then take another vessel similar in all respects to this one, with copper and zinc plates immersed, connect the first zinc with the second copper with a copper wire, and a simple pile will be formed. The wire from the first copper will have + electricity, and the wire from the last zinc will be —. Thus may any number of cells be united, beginning with the first zinc and the second copper. Then the electrode which will be connected with the first copper will be positive, and that connected with the last zinc will be negative. The molecule of water being separated, the oxygen part (negative) goes to the zinc, and the hydrogen (positive) to the copper. It is impossible to state whether the chemical action is the result of electricity or *vice versâ*, but one thing is certain, pure zinc is not acted on by the liquid unless another conductor, as copper, completes the circuit. Outside the cell the current flows from the copper to the zinc, but inside of the cell it flows from the zinc to the copper, so that here the zinc is positive and the copper negative; hence, the electro-motive force of the cell is

the difference of potential between the zinc and the copper. The electro-motive force of a battery depends entirely upon the nature of the metals used and their temperature, and not upon the size of the plates; it may be observed, however, that the internal resistance of the cell is diminished by using large plates. In batteries composed of copper and zinc plates immersed in acidulated water, we have a counter electro-motive force between the negative copper (copper being negative inside the cell) and the positive hydrogen. The current is thus weakened by the two electro-motive forces in opposite directions, so various inventions have been made to overcome this, of which the best known is the porous cup, containing sulphate of copper, which absorbs the hydrogen as in the Daniell's cell. This is what is known as a *constant* cell.

Theoretic Conditions of a Perfect Pile.—

1. Great electro-motive force.
2. A feeble and constant interior resistance.
3. The electro-motive force to be constant.
4. Cheapness.
5. Practical arrangement of the cells so that they can be easily cleaned.

Choice of Cells.—I consider the best cells for general use the *Leclanché* and the *Law*, with a decided preference for the former. The Leclanché cell of the Gonda pattern gives little trouble, is

constant, lasts for a long time, has a small internal resistance, does not waste, and has no local action. The distinctive features of the Leclanché pile are a zinc-carbon cell and an exciting fluid of sal ammoniac. To prevent polarization, the carbon plate is packed inside a porous pot along with fragments of carbon and powdered binoxide of manganese, which yields up oxygen and destroys the hydrogen bubbles.

NAMES, ELEMENTS, AND FLUIDS OF THE DIFFERENT BATTERIES.

Name of Cell.	Positive Element.	Negative Element.	Exciting Fluid.	Depolarizing Fluid.	E.M.F. in Volts.	Internal Resistance in Ohms.*
Bunsen.	Zinc.	Graphite.	Sulphuric acid dilute.	Nitric acid.	1.8	.08 to .11
Do.	"	"	"	Chromic acid.	1.8	.1 to .12
Chromic acid, single fluid.	"	"	Sulphuric acid and chromic acid, dilute mixed.	None separate.	2.2	.001 to .08
Daniell.	"	Copper.	Zinc sulphate sol.	Copper sulphate sol.	1.079	2. to 5
Fuller.	"	Graphite.	Chloride of zinc solution.	Potash bichromate and hydrochloric acid.	1.5	0.5 to 0.7
Gaiffe.	"	Silver.	Zinc chloride.	Silver chloride.	1.02	0.5 to 0.6
Grove.	"	Platinum.	Sulphuric acid dilute.	Nitric acid.	1.96	.1 to .12
Lalande Chaperon.	"	Copper or iron.	Caustic potash solution.	Oxide of copper.	0.98	1.30
Latimer Clark.	"	Pure mercury.	Sulphate of mercury.	None separate.	1.457	0.3 to 0.5

* The resistances were measured in cells standing 6″ × 4″.

NAMES, ELEMENTS, AND FLUIDS OF THE DIFFERENT BATTERIES.—*Continued.*

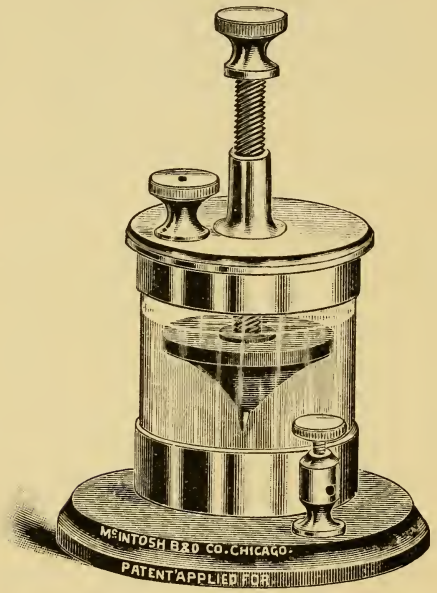
Name of Cell.	Positive Element.	Negative Element	Exciting Fluid.	Depolarizing Fluid.	E. M. F. in Volts.	Internal Resistance in Ohms.*
Leclanché.	Zinc.	Graphite.	Ammonium chloride sol.	Manganese dioxide	1.6	1.13 to 1.15
Maiche.	Zinc scraps in bath of mercury.	Platinized carbon.	Common salt solution.	None separate.	1.25	1. to .2
Marié Davy.	Zinc.	Graphite.	Sulphuric acid dilute.	Paste of sulphate of mercury.	1 52	.75 to 1
Niaudet.	"	"	Common salt solution	Chloride of lime.	1.5 to 1.6	5 to 6
Poggendorf.	"	"	Saturated sol. of potash, bichromate, and sulphuric acid.	None separate.	1.98	.001 to .08
Schanschieff	"	"	Mercurial solution.	None separate.	1.56	.05 to 0.75
Skrivanow.	"	Silver.	Caustic potash.	Chloride of silver.	1.5	1.5
Smee.	"	Platinized Silver.	Sulphuric acid dilute	None.	0.47	0.5
Walker.	"	Platinized graphite.	"	"	0.66	0.4
Warren de la Rue.	"	Silver.	Sal. ammoniac sol.	Silver chloride.	1.	0.4 to 0.6

* The resistances were measured in cells standing 6″ × 4″.

Controller.—The instrument shown in Fig. 8 is a very admirable arrangement of carbon with a platinum tip, working in a cylinder partially filled with water. The current can be regulated with much precision from a half of a m.m. up to any required resistance. I consider this controller and the one which is known as the Massey controller as the

two best now on the market, although I should blush to think that the future could not develop something better yet—for there is much to be desired. To use the carbon instrument, raise the

FIG. 8.

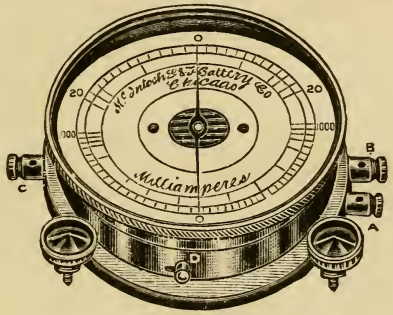


disc until it is free of the water, then turn on the full force of your battery, and the current will commence to flow, as will be shown from the milliameter, as soon as the platinum tip touches the

water. Bicarbonate of soda may be added to the water if it should be indicated.

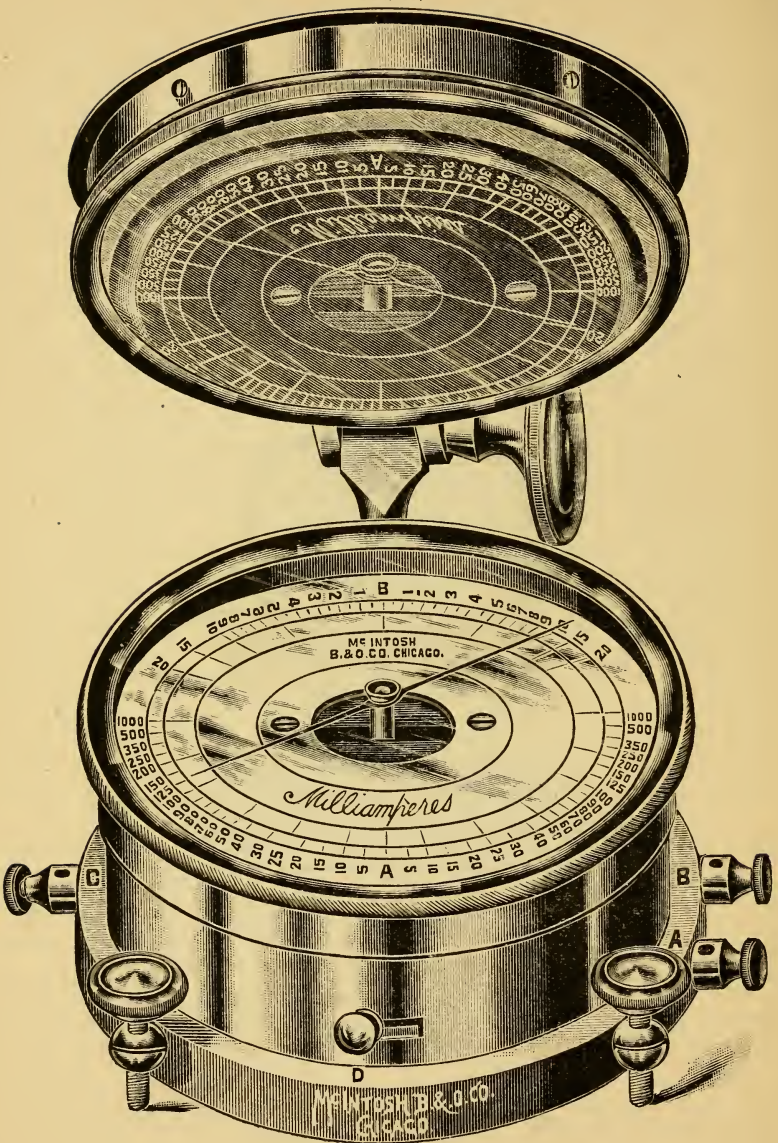
The Meter.—Without a good instrument for measuring the strength of a current, no truly scientific, reliable or encouraging work can be done in electricity. Figs. 9 and 10 are about the best on the market. I confess a preference for the horizon-

FIG. 9.



tal one—an instrument which is "dead beat" in action (that is, in which the number of vibrations is reduced to a minimum), is very desirable in neurological work especially. This instrument is carefully calibrated, and is highly commended by those who have used it. The limits of this book do not permit me to enter into a study of the theory of galvanometers and the steps of their manufacture.

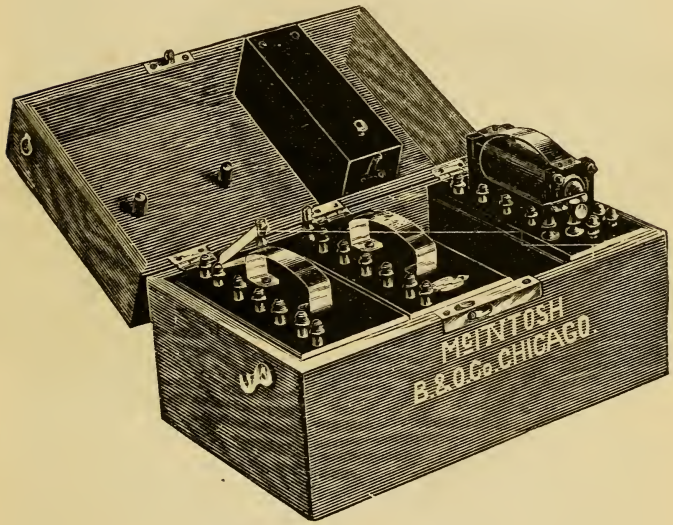
FIG. 10.


Mc INTOSH
B.&O.CO. CHICAGO.
Milliamperes
A
B
C
D
McINTOSH B.&O.CO.
CHICAGO

BATTERIES.

Portable.—The batteries made by the McIntosh Company, of Chicago, are most admirable and really

FIG. 11.



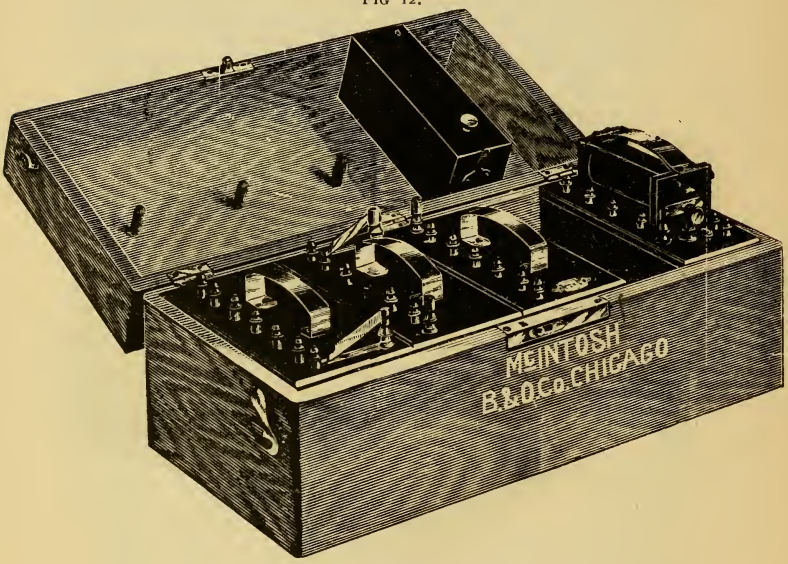
12-CELL COMBINED PORTABLE BATTERY.

will answer perfectly well for even the office use of the general practitioner.

Description of Fig. 13.—This is a most complete and ingenious contrivance. The large double switch is a current selector, and works as follows: If you

desire to use the cells from No. 1 up, place one switch on 0, and the other switch on 1, 2, 3, etc., up to any number required. Suppose the first ten cells

FIG 12.



18-CELL COMBINED PORTABLE BATTERY.

are weak, then put one switch on No. 11, and the other on 12, 13, 14, etc. A valuable arrangement this, and a saving one in any battery. The resistance coil has a power of 2500 ohms and may be used or not, at the option of the operator. The wise man would probably prefer his carbon controller.

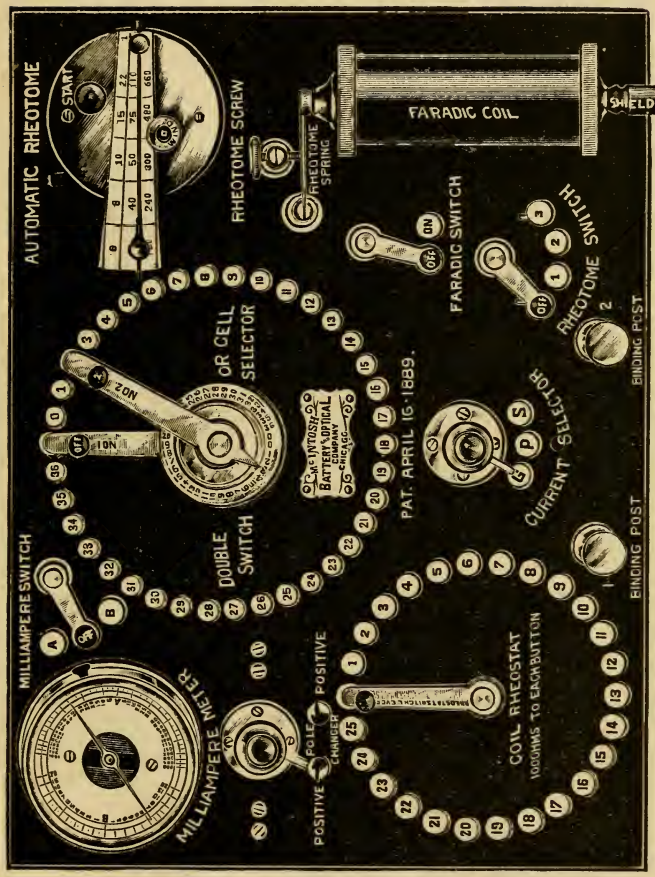


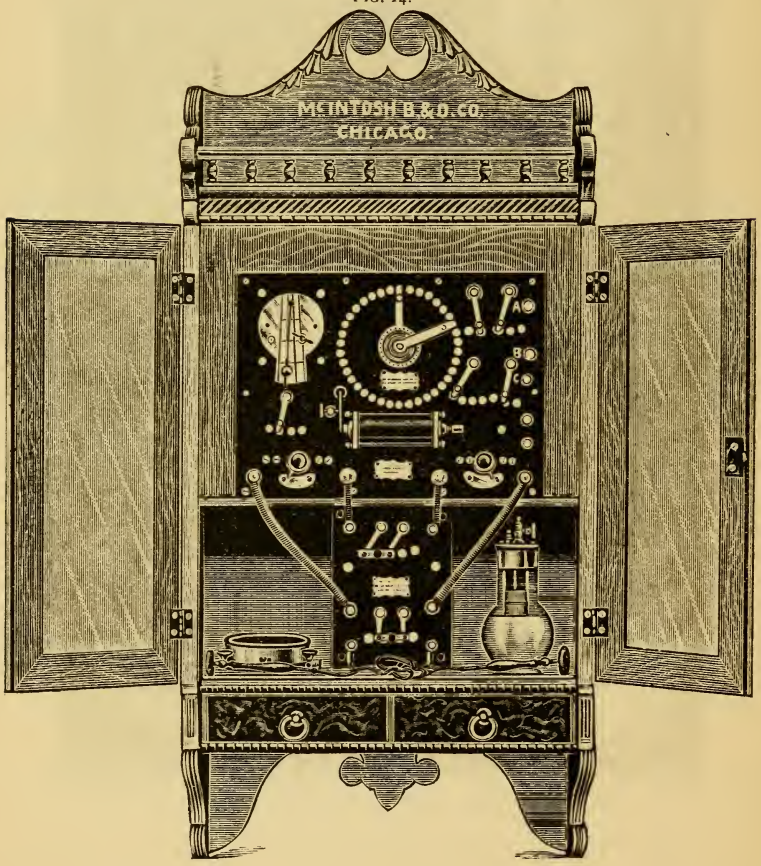
FIG. 13.

PLATE OF CABINET BATTERY.

CABINET BATTERIES.

This admirable arrangement (Fig. 14) is supplied with any cells desired—with the Induction or

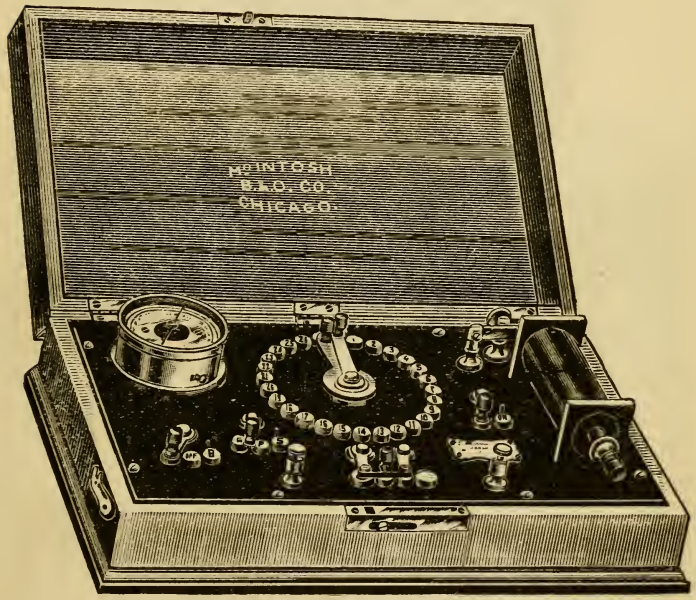
Fig. 14.



Faradic coil—with current changers, interruptors, switch-board, etc.

Fig. 15 is a more elaborate arrangement, but not expensive in comparison with some other bat-

Fig. 15.

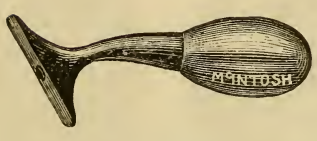


teries. The simpler the arrangement of a cabinet battery the more useful it becomes. The tendency to a great complexity and multiplication of switches I regret, because they are always sure to be more or less confusing.

FIG. 16.

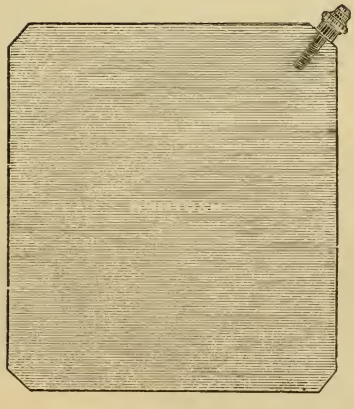
ELECTRODES.

FIG. 17.



RECTAL ELECTRODE

FIG. 18.



FOOT PLATE.

FIG. 19.

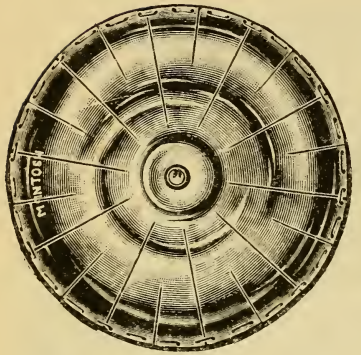
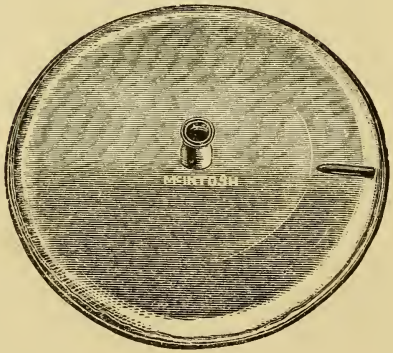


FIG. 20.

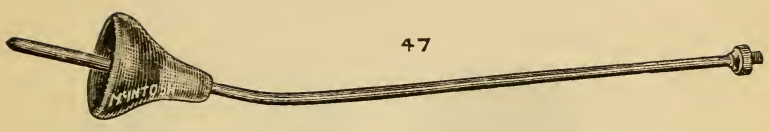
SPONGIO-PILINE ABDOMINAL ELECTRODES.

FIG. 21.



MARTIN'S ABDOMINAL ELECTRODE.

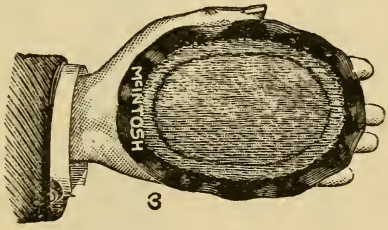
FIG. 22.



CUP ELECTRODE FOR UTERINE NECK.

FIG. 23.

FIG. 24.



FLEXIBLE ELECTRODE.

FIG. 25.

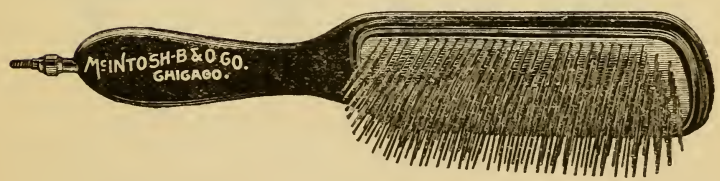
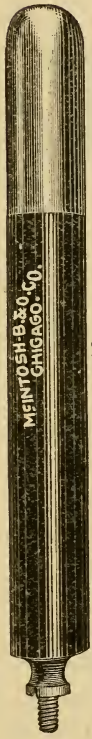
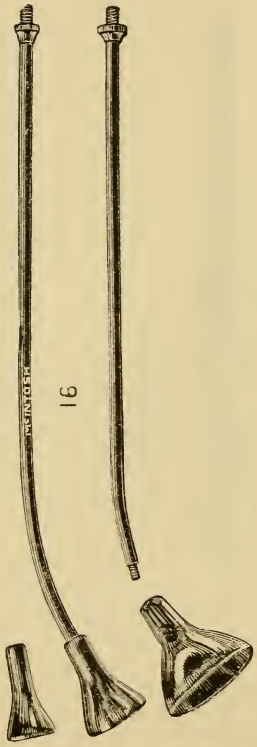


FIG. 26. LONG-STEM SPINAL ELECTRODE.

FIG. 27. NEW PLATINUM-TIPPED FLEXIBLE INTRA-UTERINE ELECTRODE.



FIGS. 28 and 29. VAGINAL ELECTRODES.



FIGS. 30 and 31. CUP ELECTRODES.

Fig. 32.

UTERINE ELECTRODE.

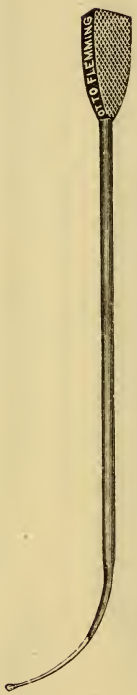


Fig. 33.

MASSEY'S STIFF PLATINUM ELECTRODE.

Fig. 34.

MASSEY'S GOLD-TIPPED PUNCTURE NEEDLE.

CHAPTER IV.

FARADIC OR INDUCED CURRENT.

In 1831 Faraday discovered that currents can be induced in a closed circuit by moving magnets near it, and he also discovered that a current whose strength is changing may induce a secondary current in a closed circuit near it. Such currents are known as *Induction Currents.* The action of a magnet or current in producing such induced currents is termed *electro-magnetic* induction.

Magnetic Induction Currents.—Insert a magnet into the hollow of a coil of insulated wire; a current is immediately caused as the magnet enters. If the magnet remain motionless no current is produced. Now withdraw the magnet rapidly and a current is established, which flows in a direction opposite to the one which was caused by the insertion of the magnet. The first induced current is called an *inverse current*, and the second is the *direct current.*

Induction Currents Produced by Currents.—Connect to a battery a small coil of stout wire, and connect to the galvanometer another coil. On sliding the smaller or "*primary*" coil into the larger or

"*secondary*" coil, a momentary inverse current is produced, and upon removing the same we have a direct current (*i. e.*, a current which runs the same way around the outer secondary coil as the primary current of the inner coil). If the circuit be broken while the primary coil lies within the secondary, we have an effect similar to that which would take place if the primary coil were suddenly removed to an infinite distance. *Making* the battery circuit while the primary coil lies within the secondary produces the same effect as plunging it suddenly into the coil.

The Induction Coil.—"The induction coil consists of a cylindrical bobbin having a central iron core surrounded by a short inner or 'primary' coil of stout wire, and by an outer 'secondary' coil consisting of many thousand turns of very fine wire, very carefully insulated between its different parts. The primary circuit is joined to the terminals of one or more cells, and in it are also included an interruptor, and a commutator or key. The object of the interruptor is to make and break the primary circuit in rapid succession. The result of this is at every 'make' to induce in the outer 'secondary' circuit a momentary inverse current, and at every 'break' a powerful momentary direct current. The currents at 'make' are suppressed, as explained below: the currents at 'break' manifest themselves

as a brilliant torrent of sparks between the ends of the secondary wires when brought near enough together. The primary coil is made of stout wire, that it may carry strong currents, and produce a powerful magnetic field at the centre, and is made of few turns to keep the resistance low, and to avoid self-induction of the primary current on itself. The central iron core is for the purpose of increasing, by its great coefficient of magnetic induction, the number of lines of force that pass through the coils: it is usually made of a bundle of fine wires to avoid the induction currents, which if it were a solid bar would be set circulating in it, and which would retard its rapidity of magnetization or demagnetization. The secondary coil is made with many turns, in order that the coefficient of mutual induction may be large; and as the electro-motive force of the induced currents will be thousands of volts, its resistance will be immaterial, and it may be made of the thinnest wire that can conveniently be found . . . The interruptors are usually self-acting . . . A common one for small coils is a 'break,' consisting of a piece of thin steel which makes contact with a platinum point, and which is drawn back by the attraction of the core on the passing of a current, and so makes and breaks circuit by vibrating backward and forward, just as does the hammer of an ordinary electric bell."

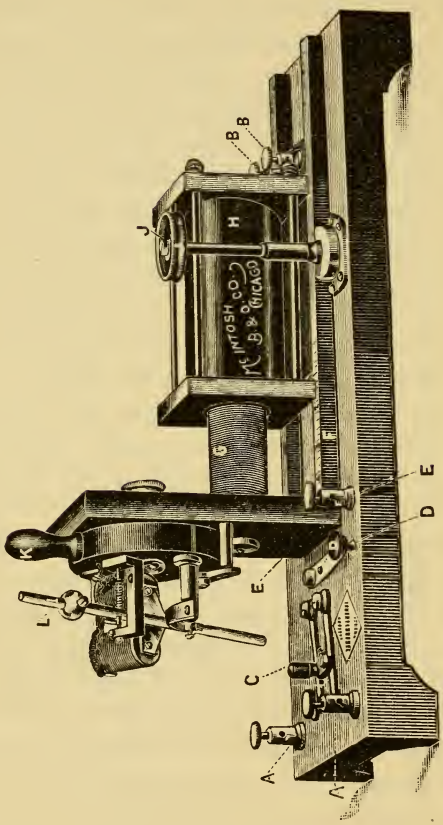
Self-Induction—Extra Currents.—Now, if two circuits approach one another so as actually to coincide, the *mutual* induction becomes a *self-induction* of the circuit on itself. The existence of self-induction in a circuit is attested by the so-called *extra-current*, which makes its appearance as a bright spark at the moment of breaking circuit. If the circuit be a simple one, and consist of a straight wire and a parallel return-wire, there will be little or no self-induction; but, if the circuit be coiled up, especially if it be coiled around an iron bar, as in an electro-magnet, then on breaking circuit there will be a brilliant spark, and a person holding the two ends of the wires between which the circuit is broken may receive a slight shock, owing to the high electro-motive force of this self-induced extra current. The extra current due to self-induction on "making" circuit is an inverse current, and gives no spark, but it prevents the battery current from rising at once to its full value. The extra current on breaking circuit is a direct current, and therefore increases the strength of the current just at the moment when it ceases altogether.

Of the Primary and Secondary Coil.—I some time ago made the assertion that I quite agreed with Tripier, Apostoli, and others in regarding the current of the "primary," or thick wire, as differing in its effects from that produced by the "secondary,"

or fine wire. Rohé and Liebig, following Dr. Massey, look upon the assertion as unfounded. Longer and continued experience does not induce me to alter this opinion. All clinical evidence seems to be in my favor, as does also the fact of the very structure of the coil. The current of the "primary" is a strong current, with a powerful magnetic field at its centre; it has a low resistance and no self-induced current. Its physiological effects are quite different from those of the secondary coil. Questions of interposed resistance, of electro-motive force and of the powerful magnetic field of the primary seem to sustain me in this belief. In my hands, the secondary current is much more useful for quieting pain than is the primary; while, on the other hand, muscular contractions are more regularly induced by the primary current. I believe, however, that in the static induced current we may have a current better than either of these.

The chloride of silver batteries, made by the John A. Barrett Co., of Baltimore, are most admirable. They are clean, portable, and are characterized by great constancy. For ordinary office work, a fifty-cell chloride of silver battery will answer every purpose. In gynæcological work, where large currents are used, especially in the percutaneous treatment of uterine fibroids, the battery exhausts itself very soon, and is unreliable. A good

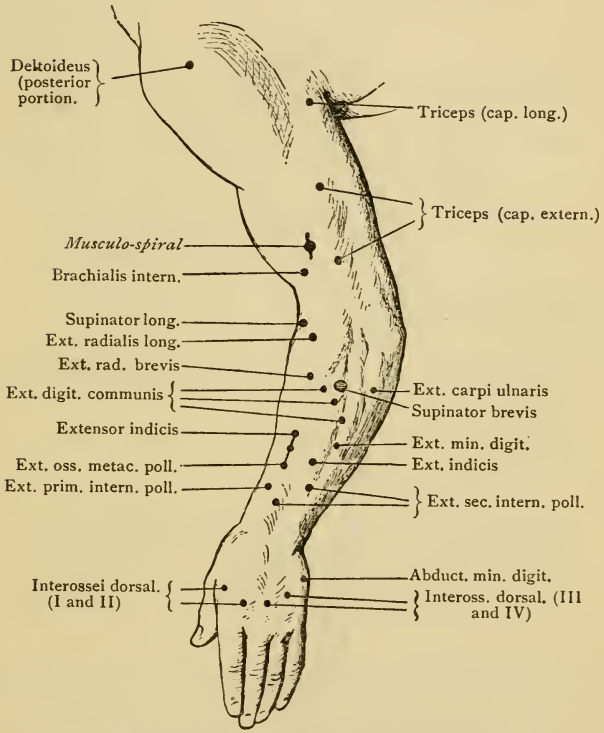
FIG. 35.



TRIPIER'S INDUCTION COIL, THE MOST RELIABLE MACHINE ON THE MARKET, WITH THREE COILS.

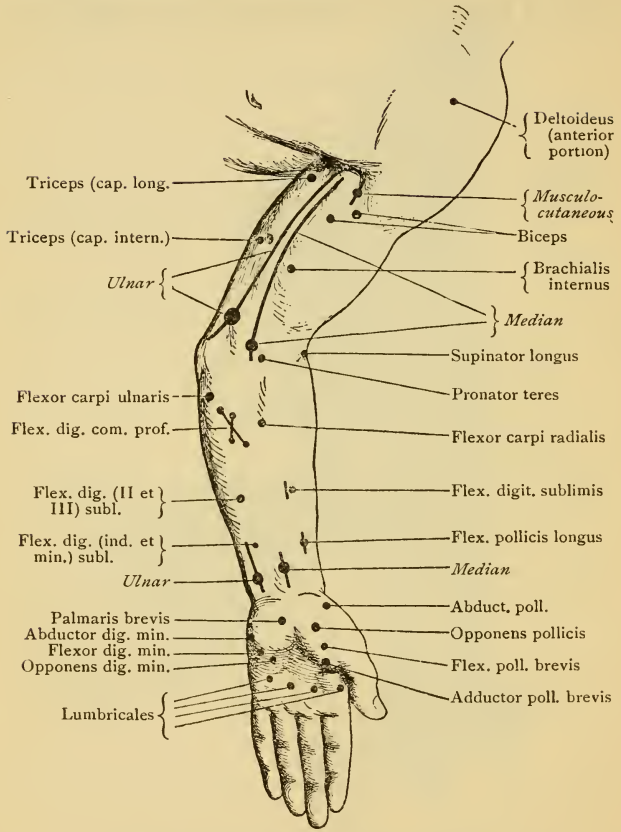
meter and a good controller are greatly needed. These I believe will shortly be on the market, as

FIG. 36.



MOTOR POINTS OF DORSAL ASPECT OF LEFT ARM.

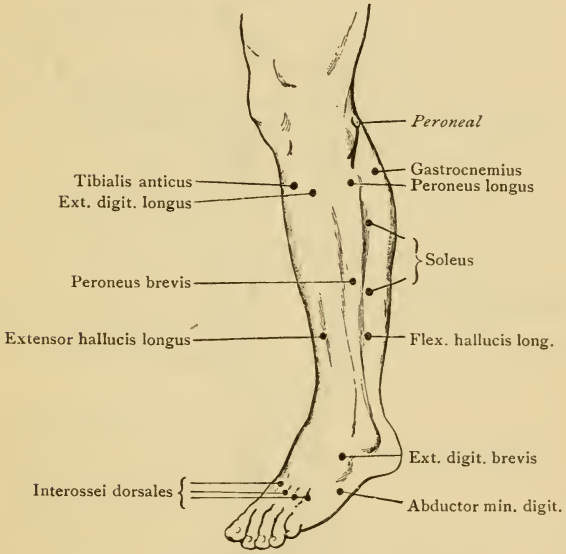
FIG. 37.



MOTOR POINTS OF INNER ASPECT OF LEFT ARM.

the chloride of silver Dry Cell Co. are bringing out a new and improved form, with new meter and controller. Still I question very seriously if any battery of this type can exhibit a fair degree of

FIG. 38.

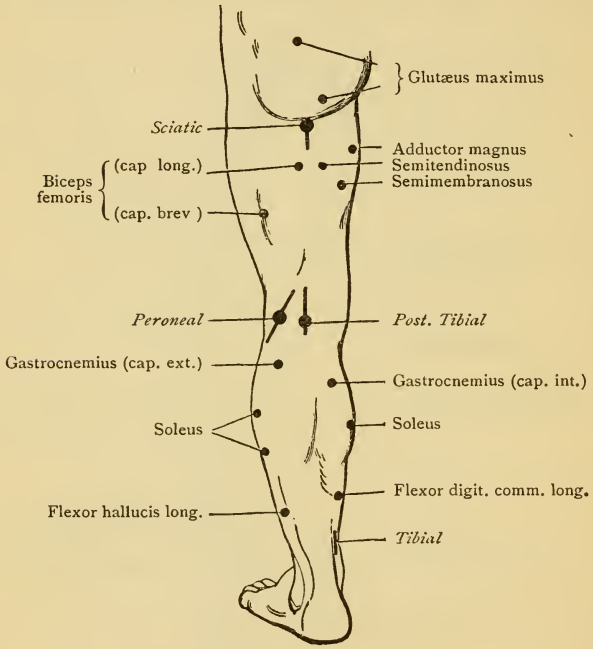


OUTER ASPECT OF LEFT LEG.

constancy and permanency where the physician is using daily large dispersing electrodes and consequently large currents. And it is a drawback that the cells must be sent to Baltimore to be recharged.

If the physician desires a more perfect demonstration of the different effects to be obtained from the

Fig. 39.



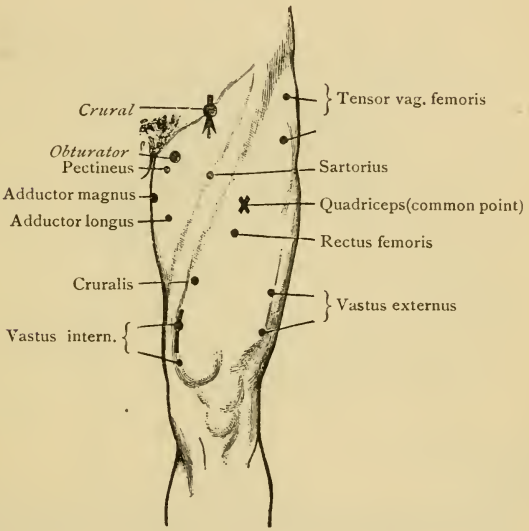
MOTOR POINTS OF POSTERIOR ASPECT OF LEFT THIGH AND LEG.

primary and secondary coils of the Faradic battery, he should ask the manufacturer to make at least 2000 turns of fine wire on the secondary bobbin,

which will give a most soothing and quieting current.

It should be remembered that the primary coil of coarse wire of the Faradic battery is the only

FIG. 40.

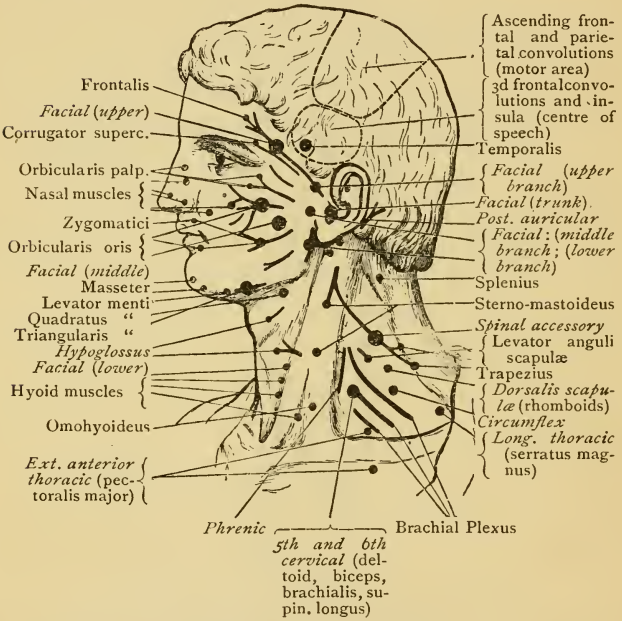


MOTOR POINTS OF ANTERIOR ASPECT OF LEFT THIGH.

one that is connected with the cell originating the current, and that the current of the secondary or fine wire coil is purely a current of induction. Duchenne was the first writer to point out the distinct physical and physiological differences between

the primary and secondary. The secondary current is a "to and fro" one, and when generated from a bobbin having a large number of turns of

FIG. 41.

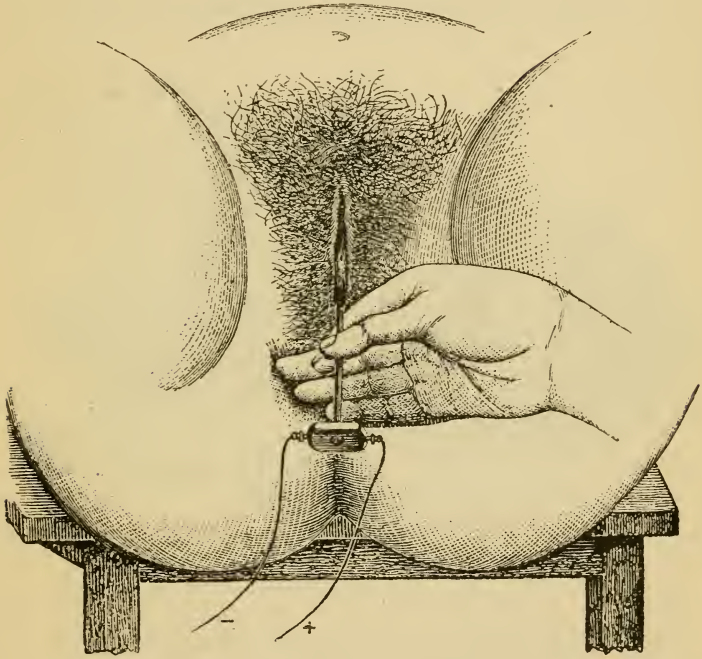


MOTOR POINTS OF FACE AND NECK.

fine wire, the sensation engendered is very similar to that produced by the Static induced current, and is entirely different from the sensation occasioned

by the primary. In ovarian pain the patient cannot tolerate the primary current, but experiences immediate relief from an application of the sec-

FIG. 42.

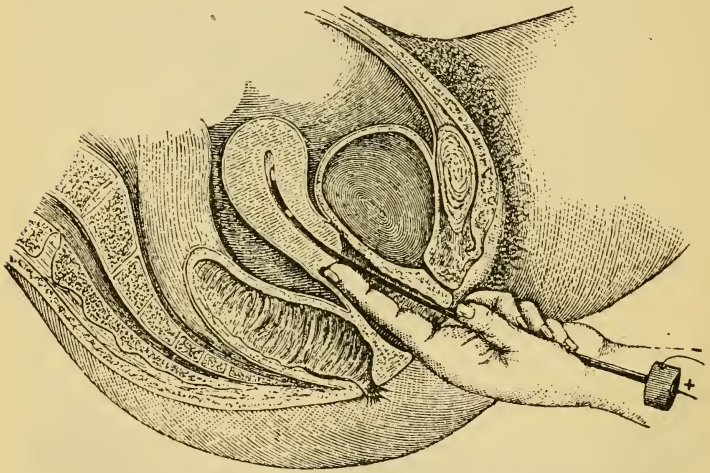


APOSTOLI'S BI-POLAR UTERINE FARADIZATION.

ondary. That is, the "tension" of the current, is entirely different. It is a current of magnetization and demagnetization, something akin to the

oscillations of the Static. The primary is feebly galvanic, the secondary is not at all so. The primary current is much more pronounced in producing muscular effects—the secondary is seen to best advantage in relieving pain. Engelmann's inven-

FIG. 43.



ELECTRODE IN POSITION.

tion, a cut of which is given, has three coils, the third coil giving, of course, a current of tension more distinct than the primary or secondary. Here the current of the secondary is opposite in direction to that of the primary, while the current of the tertiary is opposite to the secondary.

THERAPEUTIC INDEX.

Abscess.—Faradization and galvanization hasten suppuration. Open with galvanic acupuncture.

Accommodation.—*Troubles of paralysis of ciliary muscle.* Moist faradization of the globe of the eye, negative, close circuit in hand of same side. Primary current; 2 to 3 minutes sitting.

Spasm of ciliary muscle. Positive, continuous galvanization. Posterior pole to globe of eye; circuit closed by the hand; very weak current; 10 to 15 minutes sitting.

Acne.—See Skin.

Adenitis (chronic).—Moist faradization; tumor held between both excitants; primary current; 5 to 10 minutes sitting.

Alcoholism.—Ascending galvanization of spinal cord; 3 minutes; medium current.

Amenorrhœa.—In virgins lumbar sub-pubic faradization; séance, 10 to 15 minutes; primary current. Central and sub-aural galvanization, and spinal galvanization, and intra-uterine negative galvanization are all useful.

Amygdalitis.—Continuous galvanization, and in chronic forms + or — puncture of the tonsil.

Analgesia.—Dry faradization, or static spark, to analgesic surface.

Anaphrodisia.—*Due to excessive cerebration.* Ascending spinal galvanization; medium current; 3 to 5 minutes.

From insufficient spinal action. Faradization or static induction, one pole in the perineum, the other in the rectum.

Anæmia.—Static bath and spark. Ascending spinal galvanization.

Aneurism. + needle in the tumor, and a large electrode near it, protecting the parts carefully from cold. Séance 7 to 20 minutes.

Angina of the chest. Energetic faradization, revulsive about the breast. Galvanization of the left cardio-cervical region; large + electrode over the head; — electrode over the left pneumogastric at its sortie from the inferior sterno-mastoid attachments.

Anchylosis.—Active faradization and static current.

Aphonia.—Place one electrode of the static or faradic over the crico-thyroidean space, the other at the nape of the neck; mild current; 1 to 2 minutes; also excitation of same current with wet electrodes, one electrode in the crico-thyroid space, and the other over the crico-thyroid cartilage. + galvanization with laryngeal electrode, the circuit being closed at the nape of the neck, or with the hand. 3 minutes.

Arthritis.—*Chronic.* Faradization or static induction, with the two electrodes at the transverse diameter of the joint; low currents; 5 to 10 minutes. Strong galvanic currents may be used to cause absorption of any effusion. Electro-massage is often excellent.

Ascites.—Deep — rectal faradization, the circuit being closed with a large moist abdominal electrode. 5 to 10 minutes.

Asphyxia in general.—Thoracic faradization. Faradization of the diaphragm by the phrenic nerves, that are accessible, at the neck, upon the anterior face of the anterior scalenus muscle, by manipulating the clavicular border of the sterno-cleido-mastoid, an electrode over each nerve and current rapidly interrupted. Primary current; static baths.

Biliary Colic, mild form.—Static induction or faradization over the liver. + galvanization, closing circuit with the hand, or over the right pneumogastric nerve.

Blepharoptosis.—*Spinal.* — olive faradic electrode placed in the internal part of the orbital depression of the superior eyelid, the + closing the circuit at the back of the neck. 1 to 2 minutes.

Bronchitis (chronic).—Thoracic static induction.

Callosities.—Painful. Static spark, or faradization, the swelling being compressed between the electrodes.

Cancer.—Electrolysis. Galvano-cautery. — galvanization, interrupted; with large electrode, active, over the cancer, as commended by Parsons.

Catalepsy.—Galvanization, sacro-post-cervical.

Cataract.—Galvanization of the globe of the eye, circuit closed with hand of same side.

Cephalalgia.—*Congestive.* Faradization, primary, the electrodes being placed on the temples. Medium current; 3 to 5 minutes.

In *dyspeptic hemicrania*, galvanization, ascending, of the right pneumogastric. 3 minutes; medium current.

In *gouty hemicrania.* + galvanization; large tampon over frontal region; circuit closed by the hand.

Chlorosis.—Lumbar-pubic faradization or uterine faradization. Daily sittings 10 minutes at first, then 5.

Chorea.—Ascending spinal galvanization; 3 minutes; mild current; increase to 5 and 15 minutes. In young girls add to this lumbar pubic faradization.

Colic.—*Flatulent* or *dyspeptic.* Moist abdominal faradization; active over iliac fossæ. 3 to 5 minutes.

Nervous. Revulsive skin faradization of abdominal wall.

Saturnine. Same.

Nephritic. Galvanization, lumbar post-cervical. During the crisis, faradization; 10 minutes. One electrode over kidney, the other over hypogastric region. Toward the close of the crisis, the same application for 3 or 5 minutes.

Hepatic. Galvanization, right precervical region. During crisis as above (faradization), one tampon over gall duct, the other over right post-thoracic region.

Conjunctivitis. + galvanization, circuit closed on the neck. 5 to 10 minutes; feeble current. Double points of static oculo-post-cervical.

Constipation.—Lumbar post-cervical galvanization. 15 to 30 minutes.

Atonic. Abdomino-rectal faradization. 3 to 5 minutes; primary current.

Recto-epigastric galvanization. 5 minutes; medium current.

Contractions.—Static spark. Galvanization +.

Contusion.—*Recent.* Faradization. 5 to 10 minutes; primary.

Convulsions.—*Ataxic.* These are usually symptoms of central symptomatic disorders akin to cerebral paralyses and galvanization of the nervous centres, the bulb being regarded on the common centre, may be tried.

Cough.—*Whooping.* Epigastric-pre-cervical (right). Galvanization; 3 minutes; twice a day after eating.

Cornea.—(*Ulcerations, etc.*). Galvanization on globe of eye; circuit closed by the hand; ½ to 2 milliampères. 5 minutes.

Coryza. + Galvanization over nose; circuit closed by hand. Feeble current; 10 to 15 minutes.

Cramp.—*Writers'*. Centripetal galvanization. + over dorsal aspect of finger. — over neck. 3 to 5 minutes, daily. Galvanization of cerebro-spinal system. Faradization; massage of muscles.

Cretinism.—Static needle discharge over neck. Spinal galvanization.

Cyanosis (cardiac).—General faradization; 10 minutes. Galvanization of the cardio-pre-cervical region of pneumogastric.

Cystitis.—*Acute.* + galvanization. + pole at pubis or perineum; negative pole at feet or in hand. 5 to 10 minutes.

Chronic. Vesical faradization. — pole in bladder or at pubis; positive at perineum. Primary current; 3 minutes.

Cystocele.—Primary faradization; vaginal. Circuit closed at pubis; 3 minutes. Results unsatisfactory.

Delirium Tremens.—Galvanization. + pole on sacrum; negative at neck. 5 minutes; medium current strength.

Diabetes.—Spinal galvanization, ascending, 3 to 5 minutes, to quiet symptoms.

Diarrhœa.—*Accidental.* Abdominal faradization, primary; 3 to 5 minutes.

Chronic. Revulsive faradization, abdominal.

Diphtheria.—(?)

Dysmenorrhœa.—Uterine faradization, bipolar. In virgins lumbo-abdominal, primary; 3 to 5 minutes.

Obstructive from stenosis. Galvanization; Fry's electrodes.

Membranous. Intra-uterine + galvanization.

Dyspepsia.—*Gastric.* Galvanization, right pneumogastric. Positive pole over epigastrium, negative over the nerve when in front of the neck, or at the back of neck. 3 minutes; 8 to 15 milliampères.

Intestinal. Abdomino-rectal faradization.

Abdominal post-cervical galvanization.

Dysphagia.—Epigastro-cervical (post) galvanization; + pole over epigastrium, — pole at neck. 3 minutes; 5 to 10 milliampères.

Dysuria.—Galvanization; + pole at perineum; circuit closed by hand, abdomen or feet.

Eclampsia.—Spinal galvanization.

Epilepsy.—Galvanization; — pole at neck, the + pole where the patient feels the *aura.* 5 minutes. Faradization sometimes gives great relief.

Fibroma.—Galvanic puncture, according to principles laid down by Apostoli. See "Gynæcological Electro-therapeutics," Bigelow.

Galactorrhœa.— + galvanization of breasts; circuit closed by the hand.

Gastralgia.—Galvanization; + pole over epigastrium; negative pole in front of neck where the right pneumogastric enters the inferior borders of the sterno-mastoid. 3 minutes; mild current. Very useful in painful gastralgia with nausea. Supplement this with cutaneous faradization over epigastrium.

Gastrorrhœa.—Same.

Glaucoma.— + galvanization of globe of eye; circuit closed by the hand, with poles (moist) applied to eyelids, which should be closed.

Goitre.—Negative puncture.

Cystic. Cauterization negative.

Exophthalmic. + galvanization of tumor; circuit closed by hand.

Gout.—Primary faradization of painful articulation. Static spark.

Hemoptysis.—In women at critical period. Intra-uterine faradization; primary current.

In men, lumbo-abdominal faradization.

Hemorrhoids.—Positive puncture.

Hernia.—After reducing, replace finger with a moist, negative, olive-pointed electrode, with positive pole in rectum. Faradization, primary; 3 to 5 minutes.

In double inguinal hernia place electrodes in the rings.

In irreducible hernia use large, flat electrode instead of the olive-pointed one.

Hydrocele.—Negative galvanic puncture; close circuit on internal part of thigh, as practiced by Walling and others.

Hydronephrosis.— + galvanization of lumbar region as a palliative; close circuit on dorso-cervical region.

Hyperæmia.—Faradization. (?)

Hyperæsthesia.—*General.* Ascending spinal galvanization.

Local. + galvanization.

Hysteria.—Treat according to symptoms. Look to general health and state of uterus.

Incontinence *of Urine.*—Faradization; negative pole on pubis, positive on perineum. Spinal galvanization.

Inertia, *uterine.*—Faradization. If of cerebral origin, ascending spinal galvanization.

Insolation.—Spinal galvanization.

Insomnia.—Faradization localized. Spinal galvanization.

Intestinal.—*Obstruction.* Deep faradization of abdominal mass by rectal electrode; circuit close by large abdominal pole. Primary current; 2 to 5 minutes; sittings frequently repeated.

Interrupted galvanization; abdomino-rectal, — pole in rectum.

Invagination. Faradization as above.

Irritation.—*Spinal.* Faradization; one pole on sacrum, the other

on the neck. Primary current; 3 to 5 minutes; one hour after faradization of skin along the spine, ascending galvanization.

Ischuria.—Centripetal galvanization; + pole on pubis; negative pole over dorsal region. 5 to 10 minutes.

Laryngitis.—Galvanization; + pole over larynx; circuit closed at neck or by the hand.

Lipoma.—Negative puncture.

Lumbago.—Galvanization; large + electrode over the loins; the other a little higher. 3 to 5 minutes.

Menorrhagia.—Galvanization; + intra-uterine, clay electrode on abdomen.

Metritis.—Positive or negative intra-uterine galvanization, as prescribed by Apostoli, according to symptoms. Abdomino-uterine faradization, as prescribed by Tripier. In non-hemorrhagic forms, negative pole in uterus when using galvanic current.

Metrorrhagia.—Intra-uterine galvanization; + pole in uterus.

Morphinism.—Spinal galvanization.

Myelitis.—*Chronic.* Spinal galvanization.

Myodynia.—Galvanization of painful muscles.

Nausea.—Galvanization of both pneumogastrics.

Nymphomania.—Spinal galvanization; weak currents; vaginal faradization with primary current.

Œdema.—Static frictions.

Orchitis.—*Acute.* Galvanization; positive pole on tumor; negative pole on the track of the cord at the external opening of the inguinal canal.

Chronic. Same.

Ovary.—*Ovaritis.* Static induction; bipolar faradization of vagina; bipolar intra-uterine faradization.

Palpitations.—Ascending galvanization of the pneumogastric.

Paralysis.—*If due to cerebral lesion*, longitudinal, transverse and diagonal brain galvanization. If the lesion is in spinal cord, spinal galvanization. In myopathic palsies galvanization; use faradization in those cases where the farado-muscular con-

tractility is preserved; also try static sparks in the treatment of paralyzed muscles. (Read extract from Von Ziemssen, quoted by Rohé and Liebig, pages 294–295.)

Bell's Palsy. Transverse occipital brain galvanization and sub-aural galvanization; then galvanization of nerve trunk; then faradization of nerve, one pole over stylo-mastoid foramen, and the other successively over motor points of paralyzed muscles. Try static sparks along course of nerve. In a general way, it may be said, that galvanism is required for all paralysis, with muscular stimulation by the faradic or static inductive brush.

Photophobia.—Galvanization; + of globe of the eye.

Pleurisy.—*Chronic.* Faradization of thoracic wall.

Pollutions.—Ascending spinal galvanization.

Priapism.—Spinal galvanization.

Prostate.—*Simple Hypertrophy.* Recto-urethral faradization.

Retinitis.—*Chronic.* Negative faradization of globe of eye.

Retroflexion and **Retroversion** of *Uterus.*—Vesico-uterine faradization.

Satyriasis.—Spinal galvanization.

Spinal Cord.—*Chronic Meningitis* and *Pachymeningitis.* Spinal galvanization.

Meningeal Hemorrhage. Same.

Chronic Myelitis. Direct galvanization.

Multiple and *Lateral Sclerosis.* Spinal and sub-aural galvanization; peripheral faradic (skin) stimulation. Avoid faradization in lateral sclerosis.

Locomotor Ataxia. Spinal galvanization; sub-aural galvanization and static electricity to spine. Use static spark for the pains.

Poliomyelitis. (?)

Tic *Douloureux.*— + Galvanization of painful points.

Torticollis.—Longitudinal galvanization of contracted muscles.

Tumors, Fibroid of Uterus.—Puncture with galvanic currents of intensity, negative or positive, as directed by Apostoli; if necessary under ether, 100 to 200 milliampères; 5 minutes.

Definitions.—*Longitudinal brain galvanization.* Large elec-

trodes to forehead and occiput. *Stabile*, when electrodes are held firmly, and *labile* when they are moved about.

Transverse brain galvanization. Electrodes on two sides of frontal bone, temporal bones, and mastoid process. Currents 1 milliampère.

Spinal galvanization, longitudinal. Electrodes over cervical and sacral spinous processes.

Transverse. One pole over the spine, and the other in median line in front.

Sub-aural galvanization. One two-inch electrode at maxillary angle of neck, and pressed toward spine. Other electrode over 5th and 7th cervical vertebræ on opposite side. Current of 5 milliampères.

General faradization. One pole to plate under feet or buttocks, with large sponge attached, and the other to upper extremity.

Local faradization. Use metal electrodes covered with sponge or cotton. Brush electrode for skin.

MEDICAL BOOKS

Note Subject Index, Page 6

There have been sold more than
145,000 copies of Gould's Dictionaries
See Pages 12 and 13

P. BLAKISTON'S SON & COMPANY
PUBLISHERS OF MEDICAL AND SCIENTIFIC BOOKS
1012 WALNUT STREET, PHILADELPHIA

Montgomery's Gynecology

New Edition—Just Ready

A modern comprehensive Text-Book. By EDWARD E. MONTGOMERY, M.D., Professor of Gynecology in Jefferson Medical College, Philadelphia; Gynecologist to the Jefferson and St. Joseph's Hospitals, etc. Second Edition, Revised and Enlarged. 570 Illustrations, many of which are from original sources. Octavo. Cloth, $5.00; Leather, $6.00

*** This is a systematic modern treatise on Diseases of Women. The author's aim has been to produce a book that will be thorough and practical in every particular. The illustrations, nearly all of which are from original sources, have for the most part been drawn by special artists who, for a number of months, devoted their sole attention to this work. The present edition has been thoroughly revised.

"The book is one that can be recommended to the student, to the general practitioner—who must sometimes be a gynecologist to a certain extent whether he will or not—and to the specialist, as an ideal and in every way complete work on the gynecology of to-day—a practical work for practical workers."—*The Journal of the American Medical Association.*

Byford's Gynecology

Third Revised Edition

A MANUAL FOR STUDENTS AND PHYSICIANS

By HENRY T. BYFORD, M.D., Professor of Gynecology and Clinical Gynecology in the College of Physicians and Surgeons of Chicago; Professor of Clinical Gynecology, Women's Medical School of Northwestern University, and in Post-Graduate Medical School, etc. Third Edition, Enlarged. 363 Illustrations, many of which are from original drawings and several of which are Colored. 12mo.
Cloth, $3.00

"As a book to help the student to quickly review what ought to be gotten up, so as to be prepared for the early examination, it is of great service. Such a book would also make a most excellent text-book for the college class room."—*Virginia Medical Semi-Monthly*, Richmond.

By JAMES TYSON, M. D.,

Professor of Medicine, University of Pennsylvania, Physician to the Philadelphia Hospital, etc.

The Practice of Medicine. Third Edition.

A Text-Book for Physicians and Students, with Special Reference to Diagnosis and Treatment. With Colored Plates and many other Illustrations. Third Edition, Revised and Enlarged. 124 Illustrations. 8vo.

Cloth, $5.50; Leather, $6.50; Half Russia, $7.50

*** This edition has been entirely reset from new type. The author has revised it carefully and thoroughly, and added much new material and new illustrations.

"We are firmly convinced that at the present time Dr. Tyson's book on Practice can be most heartily commended to both the practitioner and student as a safe, reliable, and thoroughly up-to-date guide in the practice of medicine."—*The Therapeutic Gazette.*

"The clinical descriptions are clear and full, and the methods of treatment described are those generally recognized as being the most modern and satisfactory."—*The London Lancet.*

Guide to the Examination of Urine. Tenth Edition.

For the Use of Physicians and Students. With Colored Plate and Numerous Illustrations Engraved on Wood. Tenth Edition, Revised, Enlarged, and in many parts entirely rewritten. Cloth, $1.50

*** *A French translation of this book has been published in Paris.*

"The book is probably more widely and generally known and appreciated than any of its similars in subject and scope."—*New York Medical Journal.*

"The book is a reliable one, and should find a place in the library of every practitioner and student of medicine."—*Boston Medical and Surgical Journal.*

Handbook of Physical Diagnosis. Fourth Edition.

Revised and Enlarged. With two Colored Plates and 55 other Illustrations. 298 pages. 12mo. Cloth, $1.50

"Like everything else emanating from this distinguished author this little book is replete with practical information from beginning to end."—*The Chicago Medical Recorder.*

"The author approaches his subject from a practical point of view and the little work will prove a good friend to the student."—*The American Journal of the Medical Sciences.*

NEW THIRD EDITION—NOW READY

MORRIS' ANATOMY

Rewritten—Revised—Improved

WITH MANY NEW ILLUSTRATIONS

Out of 102 of the leading medical schools 60 recommend "Morris." It contains many features of special advantage to students. It is modern, up-to-date in every respect. It has been carefully revised, the articles on Osteology and Nervous System having been rewritten. **Each copy contains the colored illustrations and a Thumb Index.**

Octavo. With 846 Illustrations, of which 267 are printed in colors.

CLOTH, $6.00; LEATHER, $7.00

"The ever-growing popularity of the book with teachers and students is an index of its value, and it may safely be recommended to all interested."—From *The Medical Record*, New York.

"Of all the text-books of moderate size on human anatomy in the English language, Morris is undoubtedly the most up-to-date and accurate."—From *The Philadelphia Medical Journal.*

McMurrich—Embryology

THE DEVELOPMENT OF THE HUMAN BODY

With 270 Illustrations

A Text-Book for Medical Students. By J. PLAYFAIR MCMURRICH, Professor of Anatomy, Medical Department, University of Michigan. 527 pages. Cloth, $3.00

NINTH EDITION

POTTER'S MATERIA MEDICA, PHARMACY, AND THERAPEUTICS

An Exhaustive Handbook

Including the Action of Medicines, Special Therapeutics of Disease, Official and Practical Pharmacy, and Minute Directions for Prescription Writing, etc. Including over 650 Prescriptions and Formulæ. By SAMUEL O. L. POTTER, M.A., M.D., M.R.C.P. (Lond.), formerly Professor of the Principles and Practice of Medicine, Cooper Medical College, San Francisco; Major and Brigade Surgeon, U. S. Vol. Ninth Edition, Revised and Enlarged. 8vo.

With Thumb Index in each copy.

Cloth, $5.00; Leather, $6.00

*** This is the most complete and trustworthy book for the use of students and physicians. Students who purchase it will find it to contain a vast deal of information not in the usual text-books arranged in the most practical manner for facilitating study and reference. It cannot be surpassed as a physician's working book.

WHITE AND WILCOX. Materia Medica, Pharmacy, Pharmacology, and Therapeutics. Fifth Edition.

A Handbook for Students. By W. HALE WHITE, M.D., F.R.C.P., etc., Physician to, and Lecturer on Materia Medica and Therapeutics at, Guy's Hospital, etc. Fifth American Edition, Revised by REYNOLD W. WILCOX, M A, M.D., LL.D., Professor of Clinical Medicine and Therapeutics at the New York Post-Graduate Medical School and Hospital; Visiting Physician, St. Mark's Hospital; Assistant Visiting Physician, Bellevue Hospital. 12mo.

Cloth, $3.00; Leather, $3.50

SUBJECT INDEX.

Gould's Medical Dictionaries, - Pages 12, 13
Morris' Anatomy, New Edition, - - Page 4
Compends for Students, - - - - Page 27

SUBJECT.	PAGE
Alimentary Canal (see Surgery)	24
Anatomy	7
Anesthetics	18, 19
Autopsies (see Pathology)	20
Bacteriology	8
Bandaging (see Surgery)	24
Blood, Examination of	8
Brain	8
Chemistry. Physics	9
Children, Diseases of	11
Climatology	19
Clinical Charts	25
Compends	27
Consumption (see Lungs)	16
Cyclopedia of Medicine	13
Dentistry	11
Diabetes (see Urin. Organs)	25
Diagnosis	11
Diagrams (see Anatomy)	8
Dictionaries, Cyclopedias	12
Diet and Food	13
Disinfection	16
Dissectors	7
Ear	14
Electricity	14
Embryology	7
Emergencies	24
Eye	14
Fevers	15
Food	13
Formularies	21
Gynecology	15
Hay Fever	25
Heart	15
Histology	15
Hydrotherapy	19
Hygiene	16
Hypnotism	8
Insanity	8
Intestines	23
Latin, Medical (see Pharmacy)	21
Life Insurance	19
Lungs	16
Massage	17
Materia Medica	17
Mechanotherapy	17
Medical Jurisprudence	18
Mental Therapeutics	8
Microscopy	18
Milk	8, 10
Miscellaneous	18
Nervous Diseases	19
Nose	25
Nursing	20
Obstetrics	20
Ophthalmology	14
Organotherapy	18
Osteology (see Anatomy)	7
Pathology	20
Pharmacy	21
Physical Diagnosis	11
Physical Training	17
Physiology	22
Pneumotherapy	19
Poisons (see Toxicology)	18
Practice of Medicine	22
Prescription Books (Pharmacy)	21
Refraction (see Eye)	14
Rest	19
Sanitary Science	16
Serum-Therapy	17
Skin	23
Spectacles (see Eye)	14
Spine (see Nervous Diseases)	19
Stomach	23
Students' Compends	27
Surgery and Surgical Diseases	24
Technological Books	9
Temperature Charts	25
Therapeutics	17
Throat	25
Toxicology	18
Tumors (see Surgery)	24
U. S. Pharmacopœia	22
Urinary Organs	25
Urine	25
Venereal Diseases	26
Veterinary Medicine	26
Visiting Lists, Physicians'. (*Send for Special Circular.*)	
Water Analysis	16
Women, Diseases of	15

Self-Examination for Medical Students. 3500 Questions on Medical Subjects, with References to Standard Works in which the correct replies will be found. Together with Questions from State Examining Boards. 3d Ed. Paper Cover, 10 cts.

SPECIAL NOTE.—The prices given in this catalogue are net; no discount can be allowed retail purchasers under any consideration. This rule has been established in order that everyone will be treated alike, a general reduction in former prices having been made to meet previous retail discounts. Upon receipt of the advertised price any book will be forwarded by mail or express, all charges prepaid.

ANATOMY. EMBRYOLOGY.

MORRIS. Text-Book of Anatomy. Third Revised and Enlarged Edition. 846 Illustrations, 267 of which are printed in colors. *Thumb Index in Each Copy.* Cloth, $6.00; Leather, $7.00
"The ever-growing popularity of the book with teachers and students is an index of its value."—*Medical Record, New York.*

BROOMELL. Anatomy and Histology of the Human Mouth and Teeth. 2d Edition, Enlarged. 337 Illus. Cloth, $4.50

DAVISSON. Mammalian Anatomy. With Special Reference to the Cat. 110 Illustrations. *In Press.*

DEAVER. Surgical Anatomy. A Treatise on Anatomy in its Application to Medicine and Surgery. With 499 very handsome full-page Illustrations Engraved from Original Drawings made by special Artists from dissections prepared for the purpose. Three vols. By *Subscription only.*
Half Morocco or Sheep, $24.00; Half Russia, $27.00

GORDINIER. Anatomy of the Central Nervous System. With 271 Illustrations, many of which are original. Cloth, $6.00

HEATH. Practical Anatomy. 9th Edition. 321 Illus. $4.25

HOLDEN. Anatomy. A Manual of Dissections. Revised by A. HEWSON, M.D., Demonstrator of Anatomy, Jefferson Medical College, Philadelphia. 320 handsome Illustrations. 7th Ed. In two compact 12mo volumes. 850 pages. Large New Type.
Vol. I. Scalp—Face—Orbit—Neck—Throat—Thorax—Upper Extremity. $1.50
Vol. II. Abdomen—Perineum—Lower Extremity—Brain—Eye—Ear—Mammary Gland—Scrotum—Testes. $1.50

HOLDEN. Human Osteology. Comprising a Description of the Bones, with Colored Delineations of the Attachments of the Muscles. The General and Microscopical Structure of Bone and its Development. With Lithographic Plates and numerous Illustrations. 8th Edition. $5.25

HOLDEN. Landmarks, Medical and Surgical. 4th Ed. .75

HUGHES AND KEITH. Dissections. With 527 Colored Plates and other Illustrations. In three parts.
I, Upper and Lower Extremity. $3.00
II, Abdomen—Thorax. $3.00
III, Head—Neck—Central Nervous System. $3.00

LAZARUS-BARLOW. Pathological Anatomy. 21 Plates and 171 other Illustrations. *Just Ready.* $6.50

McMURRICH. Embryology. The Development of the Human Body. 276 Illustrations. $3.00

MARSHALL. Physiological Diagrams. Eleven Life-Size Colored Diagrams (each seven feet by three feet seven inches). Designed for Demonstration before the Class.
In Sheets, Unmounted, $40.00; Backed with Muslin and Mounted on Rollers, $60.00; Ditto, Spring Rollers, in handsome Walnut Wall Map Case, $100.00; Single Plates—Sheets, $5.00; Mounted, $7.50. Explanatory Key, .50. *Purchaser must pay freight charges.*

MINOT. Laboratory Text-Book of Embryology. 218 Illustrations. *Just Ready.* $4.50

POTTER. Compend of Anatomy, Including Visceral Anatomy. 7th Edition, Revised and Enlarged. 16 Plates and 138 other Illustrations. *Just Ready.* .80; Interleaved, $1.00

WILSON. Anatomy. 11th Edition. 429 Illus., 26 Plates. $5.00

YUTZY. Guide to the Dissection of the Human Body. Based on Morris' Anatomy. Paper Cover, .25

BACTERIOLOGY.

CONN. Agricultural Bacteriology. Including the Study of Bacteria as relating to Agriculture, Soil, Dairy and Food Products, Sewage, Domestic Animals, etc. Illustrated. $2.50

CONN. Bacteria in Milk and Its Products. Designed for Students of Dairying, Boards of Health, Bacteriologists, etc. Illustrated. $1.25

EMERY. Bacteriological Diagnosis. 2 Colored Plates and 32 other Illustrations. $1.50

HEWLETT. Manual of Bacteriology. 75 Illustrations. Second Edition, Revised and Enlarged. $4.00

SMITH. Laboratory Exercises in Bacteriology. A Handbook for Students. Illustrated. $1.50

WILLIAMS. Bacteriology. A Manual for Students. 88 Illustrations. 3d Edition, Revised. *Just Ready.* $1.50

BLOOD, Examination of.

DA COSTA. Clinical Hematology. A Practical Guide to the Examination of the Blood, with Reference to Diagnosis. Six Colored Plates and 48 other Illus. Cloth, $5.00; Sheep, $6.00

BRAIN AND INSANITY (see also Nervous Diseases.)

BLACKBURN. A Manual of Autopsies. Designed for the Use of Hospitals for the Insane and other Public Institutions. Ten full-page Plates and other Illustrations. $1.25

CHASE. General Paresis. Illustrated. $1.75

DERCUM. Mental Therapeutics, Rest, Suggestion. *See Cohen, Physiologic Therapeutics, page* 17.

GORDINIER. The Gross and Minute Anatomy of the Central Nervous System. With full-page and other Illus. $6.00

IRELAND. The Mental Affections of Children. 2d Ed. $4.00

LEWIS (BEVAN). Mental Diseases. A Text-Book having Special Reference to the Pathological Aspects of Insanity. 26 Lithographic Plates and other Illustrations. 2d Ed. $7.00

MANN. Manual of Psychological Medicine. $3.00

PERSHING. Diagnosis of Nervous and Mental Disease. Illustrated. $1.25

REGIS. Mental Medicine. Authorized Translation by H. M. BANNISTER, M.D. $2.00

STEARNS. Mental Diseases. With a Digest of Laws Relating to Care of Insane. Illustrated. Cloth, $2.75; Sheep, $3.25

TUKE. Dictionary of Psychological Medicine. Giving the Definition, Etymology, and Symptoms of the Terms used in Medical Psychology, with the Symptoms, Pathology, and Treatment of the Recognized Forms of Mental Disorders. Two volumes. $10.00

WOOD, H. C. Brain and Overwork. .40

CHEMISTRY AND TECHNOLOGY.

Special Catalogue of Chemical Books sent free upon application.

ALLEN. Commercial Organic Analysis. A Treatise on the Modes of Assaying the Various Organic Chemicals and Products Employed in the Arts, Manufactures, Medicine, etc., with Concise Methods for the Detection of Impurities, Adulterations, etc. 8vo.

Vol. I. Alcohols, Neutral Alcoholic Derivatives, etc., Ethers, Vegetable Acids, Starch, Sugars, etc. 3d Edition. $4.50

Vol. II, Part I. Fixed Oils and Fats, Glycerol, Explosives, etc. 3d Edition. $3.50

Vol. II, Part II. Hydrocarbons, Mineral Oils, Lubricants, Benzenes, Naphthalenes and Derivatives, Creosote, Phenols, etc. 3d Edition. $3.50

Vol. II, Part III. Terpenes, Essential Oils, Resins, Camphors, etc. 3d Edition. *Preparing.*

Vol. III, Part I. Tannins, Dyes, and Coloring Matters. 3d Edition, Enlarged and Rewritten. Illustrated. $4.50

Vol. III, Part II. The Amines, Hydrazines and Derivatives, Pyridine Bases. The Antipyretics, etc. Vegetable Alkaloids, Tea, Coffee, Cocoa, etc. 8vo. 2d Edition. $4.50

Vol. III, Part III. Vegetable Alkaloids, Non-Basic Vegetable Bitter Principles. Animal Bases, Animal Acids, Cyanogen Compounds, etc. 2d Edition, 8vo. $4.50

Vol. IV. The Proteids and Albuminous Principles. 2d Edition. $4.50

BAILEY AND CADY. Qualitative Chemical Analysis. $1.25

BARTLEY. Medical and Pharmaceutical Chemistry. A Text-Book for Medical, Dental, and Pharmaceutical Students. With Illustrations, Glossary, and Complete Index. 5th Ed. $3.00

BARTLEY. Clinical Chemistry. The Examination of Feces, Saliva, Gastric Juice, Milk, and Urine. $1.00

BLOXAM. Chemistry, Inorganic and Organic. With Experiments. 9th Ed., Revised. 281 Engravings. *Preparing.*

BUNGE. Physiologic and Pathologic Chemistry. From the Fourth German Enlarged Edition. $3.00

CALDWELL. Elements of Qualitative and Quantitative Chemical Analysis. 3d Edition, Revised. $1.00

CAMERON. Soap and Candles. 54 Illustrations. $2.00

CLOWES AND COLEMAN. Quantitative Analysis. 5th Edition. 122 Illustrations. $3.50

COBLENTZ. Volumetric Analysis. Illustrated. $1.25

CONGDON. Laboratory Instructions in Chemistry. With Numerous Tables and 56 Illustrations. $1.00

GARDNER. The Brewer, Distiller, and Wine Manufacturer. Illustrated. $1.50

GRAY. Physics. Volume I. Dynamics and Properties of Matter. 350 Illustrations. $4.50

GROVES AND THORP. Chemical Technology. The Application of Chemistry to the Arts and Manufactures.

Vol. I. Fuel and its Applications. 607 Illustrations and 4 Plates. Cloth, $5.00; ½ Mor., $6.50

Vol. II. Lighting. Illustrated. Cloth, $4.00; ½ Mor., $5.50

Vol. III. Gas Lighting. Cloth, $3.50; ½ Mor., $4.50

Vol. IV. Electric Lighting. Photometry. Cloth, $3.50; ½ Mor., $4.50

HEUSLER. The Chemistry of the Terpenes. $4.00

HOLLAND. The Urine, the Gastric Contents, the Common Poisons, and the Milk. Memoranda, Chemical and Microscopical, for Laboratory Use. 6th Ed. Illustrated. $1.00

LEFFMANN. Compend of Medical Chemistry, Inorganic and Organic. 4th Edition, Revised. .80; Interleaved, $1.00

LEFFMANN. Analysis of Milk and Milk Products. 2d Edition, Enlarged. Illustrated. $1.25

LEFFMANN. Water Analysis. For Sanitary and Technic Purposes. Illustrated. 4th Edition. $1.25

LEFFMANN. Structural Formulæ. Including 180 Structural and Stereo-Chemical Formulæ. 12mo. Interleaved. $1.00

LEFFMANN AND BEAM. Select Methods in Food Analysis. Illustrated. $2.50

MUTER. Practical and Analytical Chemistry. 3d American from the Ninth English Edition. Revised to meet the requirements of American Students. 56 Illustrations. $1.25

OETTEL. Exercises in Electro-Chemistry. Illustrated. .75

OETTEL. Electro-Chemical Experiments. Illustrated. .75

RICHTER. Inorganic Chemistry. 5th American from 10th German Edition. Authorized translation by EDGAR F. SMITH, M.A., PH.D. 89 Illustrations and a Colored Plate. $1.75

RICHTER. Organic Chemistry. 3d American Edition, translated from the 8th German by EDGAR F. SMITH. Illus. 2 vols.

Vol. I. Aliphatic Series. 625 pages. $3.00

Vol. II. Carbocyclic Series. 671 pages. $3.00

ROCKWOOD. Chemical Analysis for Students of Medicine, Dentistry, and Pharmacy. Illustrated. $1.50

SMITH. Electro-Chemical Analysis. 3d Ed. 39 Illus. $1.50

SMITH AND KELLER. Experiments. Arranged for Students in General Chemistry. 4th Edition. Illustrated. .60

SUTTON. Volumetric Analysis. A Systematic Handbook for the Quantitative Estimation of Chemical Substances by Measure, Applied to Liquids, Solids, and Gases. 8th Edition, Revised. 112 Illustrations. $5.00

SYMONDS. Manual of Chemistry. 2d Edition. $2.00

TRAUBE. Physico-Chemical Methods. 97 Illustrations. $1.50

THRESH. Water and Water Supplies. 3d Edition. $2.00

ULZER AND FRAENKEL. Chemical Technical Analysis. Translated by Fleck. Illustrated. $1.25

WOODY. Essentials of Chemistry and Urinalysis. 4th Edition. Illustrated. $1.50

*** *Special Catalogue of Books on Chemistry free upon application.*

CHILDREN.

HATFIELD. Compend of Diseases of Children. With a Colored Plate. 3d Ed. *Just Ready.* .80; Interleaved, $1.00

IRELAND. The Mental Affections of Children. Idiocy, Imbecility, Insanity, etc. 2d Edition. $4.00

POWER. Surgical Diseases of Children and their Treatment by Modern Methods. Illustrated. $2.50

STARR. The Digestive Organs in Childhood. The Diseases of the Digestive Organs in Infancy and Childhood. 3d Edition, Rewritten and Enlarged. Illustrated. $3.00

STARR. Hygiene of the Nursery. Including the General Regimen and Feeding of Infants and Children, and the Domestic Management of the Ordinary Emergencies of Early Life, Massage, etc. 6th Edition. 25 Illustrations. $1.00

SMITH. Wasting Diseases of Children. 6th Edition. $2.00

TAYLOR AND WELLS. The Diseases of Children. 2d Edition, Revised and Enlarged. Illustrated. 8vo. $4.50

"It is well worthy the careful study of both student and practitioner, and can not fail to prove of great value to both. We do not hesitate to recommend it."—*Boston Medical and Surgical Journal.*

DIAGNOSIS.

BROWN. Medical Diagnosis. A Manual of Clinical Methods. 4th Edition. 112 Illustrations. Cloth, $2.25

DA COSTA. Clinical Hematology. A Practical Guide to Examination of Blood, with Reference to Diagnosis. 6 Colored Plates, 48 other Illustrations. Cloth, $5.00; Sheep, $6.00

DOUGLAS. Surgical Diseases of Abdomen, with Reference to Diagnosis. 20 Full-Page Plates. *Just Ready.* Cloth, $7.00 ; Sheep, $8.00

EMERY. Bacteriological Diagnosis. 2 Colored Plates and 32 other Illustrations. $1.50

MEMMINGER. Diagnosis by the Urine. 2d Ed. 24 Illus. $1.00

PERSHING. Diagnosis of Nervous and Mental Diseases. Illustrated. $1.25

STEELL. Physical Signs of Pulmonary Disease. $1.25

TYSON. Handbook of Physical Diagnosis. For Students and Physicians. By the Professor of Clinical Medicine in the University of Pennsylvania. Illus. 4th Ed., Improved and Enlarged. With 2 Colored and 55 other Illustrations. $1.50

DENTISTRY.

Special Catalogue of Dental Books sent free upon application.

BARRETT. Dental Surgery for General Practitioners and Students of Medicine and Dentistry. Extraction of Teeth, etc. 3d Edition. Illustrated. $1.00

BROOMELL. Anatomy and Histology of the Human Mouth and Teeth. Second Edition, Revised and Enlarged. 337 handsome Illustrations. Cloth, $4.50; Leather, $5.50

FILLEBROWN. Operative Dentistry. Illustrated. $2.25

GORGAS. Dental Medicine. A Manual of Materia Medica and Therapeutics. 7th Edition. Cloth, $4.00; Sheep, $5.00

GORGAS. Questions and Answers for the Dental Student. Embracing all the subjects in the Curriculum of the Dental Student. Octavo. $6.00

HARRIS. Principles and Practice of Dentistry. Including Anatomy, Physiology, Pathology, Therapeutics, Dental Surgery, and Mechanism. 13th Edition. Revised by F. J. S. GORGAS, M.D., D.D.S. 1250 Illus. Cloth, $6.00; Leather, $7.00

HARRIS. Dictionary of Dentistry. Including Definitions of Such Words and Phrases of the Collateral Sciences as Pertain to the Art and Practice of Dentistry. 6th Edition, Revised and Enlarged by FERDINAND J. S. GORGAS, M.D., D.D.S. Cloth, $5.00; Leather, $6.00

RICHARDSON. Mechanical Dentistry. 7th Edition. Thoroughly Revised and Enlarged by DR. GEO. W. WARREN. 691 Illustrations. Cloth, $5.00; Leather, $6.00

SMITH. Dental Metallurgy. 2d Edition. Illustrated. $2.00

TAFT. Index of Dental Periodical Literature. $2.00

TOMES. Dental Anatomy. 263 Illustrations. 5th Ed. $4.00

TOMES. Dental Surgery. 4th Edition. 289 Illus. $4.00

WARREN. Compend of Dental Pathology and Dental Medicine. With a Chapter on Emergencies. 3d Edition. Illustrated. .80; Interleaved, $1.00

WARREN. Dental Prosthesis and Metallurgy. 129 Illus. $1.25

WHITE. The Mouth and Teeth. Illustrated. .40

DICTIONARIES. CYCLOPEDIAS.

GOULD. The Illustrated Dictionary of Medicine, Biology, and Allied Sciences. Being an Exhaustive Lexicon of Medicine and those Sciences Collateral to it: Biology (Zoology and Botany), Chemistry, Dentistry, Pharmacology, Microscopy, etc., with many useful Tables and numerous fine Illustrations. 1633 pages. Fifth Edition.
Sheep or Half Morocco, $10.00; with Thumb Index, $11.00
Half Russia, Thumb Index, $12.00

GOULD. The Medical Student's Dictionary. 11th Edition. Illustrated. Including those Words and Phrases generally used in Medicine, with their Proper Pronunciation and Definition, Based on Recent Medical Literature. With Table of Eponymic Terms and Tests and Tables of the Bacilli, Micrococci, Mineral Springs, etc., of the Arteries, Muscles, Nerves, Ganglia, Plexuses, etc. Eleventh Edition. Enlarged and illustrated with a large number of Engravings. 840 pages.
Half Morocco, $2.50; with Thumb Index, $3.00
Flexible Leather, Burnished Edges, Thumb Index, 3.50

GOULD. The Pocket Pronouncing Medical Lexicon. 4th Edition. (30,000 Medical Words Pronounced and Defined.) Containing all the Words, their Definition and Pronunciation, that the Medical, Dental, or Pharmaceutical Student Generally Comes in Contact with; also Elaborate Tables of Eponymic Terms, Arteries, Muscles, Nerves, Bacilli, etc., etc., a Dose List in both English and Metric Systems, etc., Arranged in a Most Convenient Form for Reference and Memorizing. Fourth Edition, Revised and Enlarged. 838 pages.
Full Limp Leather, Gilt Edges, $1.00; Thumb Index, $1.25
145,000 Copies of Gould's Dictionaries have been sold.

GOULD AND PYLE. Cyclopedia of Practical Medicine and Surgery. Seventy-two Special Contributors. Illustrated. One Volume. A Concise Reference Handbook of Medicine, Surgery, Obstetrics, Materia Medica, Therapeutics, and the Various Specialties, with Particular Reference to Diagnosis and Treatment. Compiled under the Editorial Supervision of GEORGE M. GOULD, M.D., Author of "An Illustrated Dictionary of Medicine," etc.; and WALTER L. PYLE, M.D., Assistant Surgeon Wills Eye Hospital; formerly Editor "International Medical Magazine," etc., and Seventy-two Special Contributors. With many Illustrations. Large Square 8vo, to correspond with Gould's "Illustrated Dictionary."
Full Sheep or Half Mor., $10.00; with Thumb Index, $11.00
Half Russia, Thumb Index, $12.00 net.

GOULD AND PYLE. Pocket Cyclopedia of Medicine and Surgery. Based upon above book and uniform in size with "Gould's Pocket Dictionary."
Full Limp Leather, Gilt Edges, $1.00
With Thumb Index, $1.25

HARRIS. Dictionary of Dentistry. Including Definitions of Such Words and Phrases of the Collateral Sciences as Pertain to the Art and Practice of Dentistry. 6th Edition, Revised and Enlarged by FERDINAND J. S. GORGAS, M.D., D.D.S.
Cloth, $5.00; Leather, $6.00

LONGLEY. Pocket Medical Dictionary. Cloth, .75

TREVES AND LANG. German-English Medical Dictionary.
Half Calf, $3.25

DIET AND FOOD.

ALLEN. Proteids and Albuminous Principles. An analytical Study of Food Products. 2d Edition. $4.50

BURNETT. Foods and Dietaries. A Manual of Clinical Dietetics, with Diet Lists for Various Diseases, etc. 2d Ed. $1.50

DAVIS. Dietotherapy. Food in Health and Disease. With Tables of Dietaries, Relative Value of Foods, etc. *See Cohen, Physiologic Therapeutics, page* 17.

GREENISH. Microscopical Examination of Foods and Drugs. Illustrated. *Just Ready.* $3.50

HAIG. Diet and Food. Considered in Relation to Strength and Power of Endurance. 4th Edition. $1.00

LEFFMANN. Select Methods in Food Analysis. Illus. $2.50

EAR (see also Throat and Nose).

BURNETT. Hearing and How to Keep It. Illustrated. .40

HOVELL. Diseases of the Ear and Naso-Pharynx. Including Anatomy and Physiology of the Organ, together with the Treatment of the Affections of the Nose and Pharynx which Conduce to Aural Disease. 128 Illustrations. 2d Ed. $5.50

PRITCHARD. Diseases of the Ear. 4th Edition, Enlarged. Many Illustrations and Formulæ. *In Press.*

ELECTRICITY.

BIGELOW. Plain Talks on Medical Electricity and Batteries. With a Therapeutic Index and a Glossary. 43 Illustrations. 2d Edition. $1.00

HEDLEY. Therapeutic Electricity and Practical Muscle Testing. 99 Illustrations. $2.50

JACOBY. Electrotherapy. 2 volumes. Illustrated. *See Cohen, Physiologic Therapeutics, page* 17.

JONES. Medical Electricity. 3d Edition. 117 Illus. $3.00

EYE.

A Special Circular of Books on the Eye sent free upon application.

DARIER. Ocular Therapeutics. *Just Ready.* $3.00

DONDERS. The Nature and Consequences of Anomalies of Refraction. With Portrait and Illus. Half Morocco, $1.25

FICK. Diseases of the Eye and Ophthalmoscopy. Translated by A. B. HALE, M.D. 157 Illus. Cloth, $4.50; Sheep, $5.50

GOULD AND PYLE. Compend of Diseases of the Eye and Refraction. Including Treatment and Operations, and a Section on Local Therapeutics. With Formulæ, Useful Tables, a Glossary, and 111 Illus., several of which are in colors. 2d Edition, Revised. Cloth, .80; Interleaved, $1.00

GREEFF. The Microscopic Examination of the Eye. Illustrated. $1.25

HARLAN. Eyesight, and How to Care for It. Illus. .40

HARTRIDGE. On the Ophthalmoscope. 4th Edition. With 4 Colored Plates and 68 Wood-cuts. $1.50

HARTRIDGE. Refraction. 104 Illustrations and Test Types. 12th Edition, Enlarged. $1.50

HANSELL AND SWEET. Treatise on Diseases of the Eye. With many Illus. drawn by special artists, etc. *In Press.*

HANSELL AND REBER. Muscular Anomalies of the Eye. Illustrated. $1.50

HANSELL AND BELL. Clinical Ophthalmology. Colored Plate of Normal Fundus and 120 Illustrations. $1.50

HENDERSON. Notes on the Eye. 3d Ed. *Just Ready.* $1.50

JENNINGS. Manual of Ophthalmoscopy. 95 Illustrations and 1 Colored Plate. $1.50

MORTON. Refraction of the Eye. Its Diagnosis and the Correction of its Errors. 6th Edition. $1.00

OHLEMANN. Ocular Therapeutics. Authorized Translation, and Edited by DR. CHARLES A. OLIVER. $1.75

PARSONS. Elementary Ophthalmic Optics. With Diagrammatic Illustrations. $2.00

PHILLIPS. Spectacles and Eyeglasses. Their Prescription and Adjustment. 3d Edition. 52 Illustrations. $1.00

SWANZY. Diseases of the Eye and Their Treatment. 8th Edition, Revised and Enlarged. 167 Illustrations, 1 Plain Plate, and a Zephyr Test Card. *Just Ready.* $2.50

From The Medical News.

"Swanzy has succeeded in producing the most intellectually conceived and thoroughly executed résumé of the science within the limits he has assigned himself. As a 'student's handbook,' small in size and of moderate price, it can hardly be equaled."

THORINGTON. Retinoscopy. 4th Edition, Carefully Revised. Illustrated. $1.00

THORINGTON. Refraction and How to Refract. 200 Illustrations, 13 of which are colored. 2d Edition. $1.50

WALKER. Student's Aid in Ophthalmology. Colored Plate and 40 other Illustrations and a Glossary. $1.50

WORTH. Squint: Its Causes, Pathology, Treatment. $2.00

WRIGHT. Ophthalmology. 2d Edition, Revised and Enlarged. 117 Illustrations and a Glossary. $3.00

FEVERS.

GOODALL AND WASHBOURN. Fevers and Their Treatment. Illustrated. $3.00

GYNECOLOGY.

BISHOP. Uterine Fibromyomata. Their Pathology, Diagnosis, and Treatment. Illustrated. Cloth, $3.50

BYFORD (H. T.). Manual of Gynecology. 3d Edition, Revised and Enlarged. 363 Illustrations. $3.00; Sheep, $3.50

DÜHRSSEN. A Manual of Gynecological Practice. 105 Illustrations. $1.50

FULLERTON. Surgical Nursing. 3d Edition, Revised and Enlarged. 69 Illustrations. $1.00

LEWERS. Diseases of Women. 146 Illus. 5th Ed. $2.50

LEWERS. Cancer of the Uterus. *Just Ready.* $3.00

MONTGOMERY. Practical Gynecology. A Complete Systematic Text-Book. 2d Edition, Revised and Enlarged. With 570 Illus. *Just Ready.* Cloth, $5.00; Leather, $6.00

ROBERTS. Gynecological Pathology. With 127 Full-page Plates containing 151 Figures. $6.00

WELLS. Compend of Gynecology. Illustrated. 3d Edition, Revised and Enlarged. *Just Ready.* .80; Interleaved, $1.00

HEART.

THORNE. The Schott Methods of the Treatment of Chronic Heart Disease. Fourth Edition. Illustrated. $2.00

HISTOLOGY.

CUSHING. Compend of Histology. By H. H. CUSHING, M.D., Demonstrator of Histology, Jefferson Medical College, Philadelphia. Illus. *Nearly Ready.* .80; Interleaved, $1.00

LAZARUS-BARLOW. Pathological Anatomy and Histology. Illustrated. *Just Ready.* $6.50

STIRLING. Outlines of Practical Histology. 368 Illustrations. 2d Edition, Revised and Enlarged. With new Illus. $2.00

STÖHR. Histology and Microscopical Anatomy. Edited by A. SCHAPER, M.D., University of Breslau, formerly Demonstrator of Histology, Harvard Medical School. Fifth American from 10th German Edition, Revised and Enlarged. 353 Illustrations. $3.00

HYGIENE.

Special Catalogue of Books on Hygiene sent free upon application.

CANFIELD. Hygiene of the Sick-Room. A Book for Nurses and Others. Being a Brief Consideration of Asepsis, Antisepsis, Disinfection, Bacteriology, Immunity, Heating, Ventilation, etc. $1.25

CONN. Agricultural Bacteriology. Illustrated. $2.50

CONN. Bacteriology of Milk and Milk Products. Illus. $1.25

COPLIN. Practical Hygiene. A Complete American Text-Book. 138 Illustrations. New Edition. *Preparing.*

HARTSHORNE. Our Homes. Illustrated. .40

KENWOOD. Public Health Laboratory Work. 116 Illustrations and 3 Plates. $2.00

LEFFMANN. Select Methods in Food Analysis. 53 Illustrations and 4 Plates. $2.50

LEFFMANN. Examination of Water for Sanitary and Technical Purposes. 4th Edition. Illustrated. $1.25

LEFFMANN. Analysis of Milk and Milk Products. Illustrated. Second Edition. $1.25

LINCOLN. School and Industrial Hygiene. .40

McFARLAND. Prophylaxis and Personal Hygiene. Care of the Sick. *See Cohen, Physiologic Therapeutics, page* 17.

NOTTER. The Theory and Practice of Hygiene. 15 Plates and 138 other Illustrations. 8vo. 2d Edition. $7.00

PARKES AND KENWOOD. Hygiene and Public Health. 2d Edition, Enlarged. Illustrated. $3.00

ROSENAU. Disinfection and Disinfectants. Illus. $2.00

STARR. The Hygiene of the Nursery. Including the General Regimen and Feeding of Infants and Children, and the Domestic Management of the Ordinary Emergencies of Early Life, Massage, etc. 6th Edition. 25 Illustrations. $1.00

STEVENSON AND MURPHY. A Treatise on Hygiene. By Various Authors. In three octavo volumes. Illustrated. Vol. I, $6.00; Vol. II, $6.00; Vol. III, $5.00

THRESH. Water and Water Supplies. 3d Edition. $2.00

WILSON. Handbook of Hygiene and Sanitary Science. With Illustrations. 8th Edition. $3.00

WEYL. Sanitary Relations of the Coal-Tar Colors. Authorized Translation by HENRY LEFFMANN, M.D., PH.D. $1.25

LUNGS AND PLEURÆ.

KNOPF. Pulmonary Tuberculosis. Its Modern Prophylaxis and Treatment in Special Institutions and at Home. Illus. $3.00

STEELL. Physical Signs of Pulmonary Disease. Illus. $1.25

MASSAGE. PHYSICAL EXERCISE.

OSTROM. Massage and the Original Swedish Movements. Their Application to Various Diseases of the Body. A Manual for Students, Nurses, and Physicians. Fifth Edition, Enlarged. 115 Illustrations, many of which are original. $1.00

MITCHELL AND GULICK. Mechanotherapy. Exercise, Orthopedics, Massage, Ocular Corrections, etc. Illustrated. *See Cohen, Physiologic Therapeutics, below.*

TREVES. Physical Education. Its Value, Methods, etc. .75

MATERIA MEDICA AND THERAPEUTICS.

BRACKEN. Outlines of Materia Medica and Pharmacology. $2.75

COBLENTZ. The Newer Remedies. Including their Synonyms, Sources, Methods of Preparation, Tests, Solubilities, Doses, etc. 3d Edition, Enlarged and Revised. $1.00

COHEN. Physiologic Therapeutics. Methods other than Drug-Giving useful in the Prevention of Disease and in the Treatment of the Sick. Mechanotherapy, Mental Therapeutics, Suggestion, Electrotherapy, Climatology, Hydrotherapy, Pneumatotherapy, Prophylaxis, Dietetics, Organotherapy, Phototherapy, Mineral Waters, Baths, etc. 11 volumes, 8vo. Illustrated. (*Subscription.*) Cloth, $27.50; ½ Mor., $38.50
Special Descriptive Circular will be sent upon application.

GORGAS. Dental Medicine. A Manual of Materia Medica and Therapeutics. 7th Edition, Revised. $4.00

GROFF. Materia Medica for Nurses, with Questions for Self-Examination. 2d Edition, Revised and Improved. $1.25

HELLER. Essentials of Materia Medica, Pharmacy, and Prescription Writing. $1.50

HEWLETT. Serum-Therapy. *In Press.*

MAYS. Theine in the Treatment of Neuralgia. ½ bound. .50

POTTER. Handbook of Materia Medica, Pharmacy, and Therapeutics, including the Action of Medicines, Special Therapeutics, Pharmacology, etc., including over 600 Prescriptions and Formulæ. 9th Edition, Revised and Enlarged. With Thumb Index in each copy. *Just Ready.* Cloth, $5.00; Sheep, $6.00
"In conclusion we may add that Dr. Potter's Therapeutics covers a wider field than many books which bear this title. He discusses a good many drugs which are rarely employed, and therefore the book is as useful to one who wishes to look for unusual information as it is to him who wishes a handbook for ready reference in the treatment of disease as he meets it from day to day."—*Therapeutic Gazette.*

POTTER. Compend of Materia Medica, Therapeutics, and Prescription Writing, with Special Reference to the Physiological Action of Drugs. 6th Edition. .80; Interleaved, $1.00

MURRAY. Rough Notes on Remedies. 4th Edition. $1.25

SAYRE. Organic Materia Medica and Pharmacognosy. An Introduction to the Study of the Vegetable Kingdom and the Vegetable and Animal Drugs. Comprising the Botanical and Physical Characteristics, Source, Constituents, and Pharmacopeial Preparations, Insects Injurious to Drugs, and Pharmacal Botany. With sections on Histology and Microtechnique, by W. C. Stevens. 374 Illustrations, many of which are original. 2d Edition. Cloth, $4.50

TAVERA. Medicinal Plants of the Philippines. $2.00

WHITE AND WILCOX. Materia Medica, Pharmacy, Pharmacology, and Therapeutics. 5th American Edition, Revised by REYNOLD W. WILCOX, M.A., M.D., LL.D., Professor of Clinical Medicine and Therapeutics at the New York Post-Graduate Medical School. Cloth, $3.00; Leather, $3.50

"The care with which Dr. Wilcox has performed his work is conspicuous on every page, and it is evident that no recent drug possessing any merit has escaped his eye. We believe, on the whole, this is the best book on Materia Medica and Therapeutics to place in the hands of students, and the practitioner will find it a most satisfactory work for daily use."—*The Cleveland Medical Gazette.*

MEDICAL JURISPRUDENCE AND TOXICOLOGY.

REESE. Medical Jurisprudence and Toxicology. A Text-Book for Medical and Legal Practitioners and Students. 6th Edition. Revised by HENRY LEFFMANN, M.D. Cloth, $3.00; Leather, $3.50

"To the student of medical jurisprudence and toxicology it is invaluable, as it is concise, clear, and thorough in every respect." —*The American Journal of the Medical Sciences.*

MANN. Forensic Medicine and Toxicology. Illus. $6.50

TANNER. Memoranda of Poisons. Their Antidotes and Tests. 9th Edition, by DR. HENRY LEFFMANN. *Just Ready.* .75

MICROSCOPY.

CARPENTER. The Microscope and Its Revelations. 8th Edition, Revised and Enlarged. 817 Illustrations and 23 Plates. Cloth, $8.00; Half Morocco, $9.00

GREENISH. Microscopical Examination of Foods and Drugs. Illustrated. *Just Ready.* $3.50

LEE. The Microtomist's Vade Mecum. A Handbook of Methods of Microscopical Anatomy. 887 Articles. 5th Edition, Enlarged. $4.00

OERTEL. Medical Microscopy. A Guide to Diagnosis, Elementary Laboratory Methods and Microscopic Technic. 131 Illustrations. *Just Ready.* $2.00

REEVES. Medical Microscopy, including Chapters on Bacteriology, Neoplasms, Urinary Examination, etc. Numerous Illustrations, some of which are printed in colors. $2.50

WETHERED. Medical Microscopy. A Guide to the Use of the Microscope in Practical Medicine. 100 Illustrations. $2.00

MISCELLANEOUS.

BERRY. Diseases of Thyroid Gland. Illustrated. $4.00

BUXTON. Anesthetics. Illustrated. 3d Edition. $1.50

COHEN. Organotherapy. *See Cohen, Physiologic Therapeutics, page* 17.

FRENKEL. Tabetic Ataxia. Illustrated. $3.00

GOULD. Borderland Studies. Miscellaneous Addresses and Essays. 12mo. $2.00

GOULD. Biographic Clinics. The Origin of the Ill-Health of DeQuincy, Carlyle, Darwin, Huxley, and Browning. *Just Ready.* $1.00

GREENE. Medical Examination for Life Insurance. Illus. With colored and other Engravings. 2d Edition. *In Press.*

HAIG. Causation of Disease by Uric Acid. The Pathology of High Arterial Tension, Headache, Epilepsy, Gout, Rheumatism, Diabetes, Bright's Disease, etc. 6th Edition. $3.50

HENRY. A Practical Treatise on Anemia. Half Cloth, .50

NEW SYDENHAM SOCIETY'S PUBLICATIONS. Circulars upon application. Per Annum, $8.00

OSGOOD. The Winter and Its Dangers. .40

PACKARD. Sea Air and Sea Bathing. .40

RICHARDSON. Long Life and How to Reach It. .40

SCHEUBE. Diseases of Warm Countries. Illustrated. *Just Ready.* $8.00

TISSIER. Pneumotherapy, Aerotherapy, Inhalation Methods. *See Cohen, Physiologic Therapeutics, page* 17.

TURNBULL. Artificial Anesthesia. 4th Ed. Illus. $2.50

WARDEN. The Paris Medical School. Paper, .75

WEBER AND HINSDALE. Climatology and Health Resorts. Including Mineral Springs. 2 vols. Illustrated with Colored Maps. *See Cohen, Physiologic Therapeutics, page* 17.

WILSON. The Summer and Its Diseases. .40

WINTERNITZ. Hydrotherapy, Thermotherapy, Phototherapy, Mineral Waters, Baths, etc. Illustrated. *See Cohen, Physiologic Therapeutics, page* 17.

NERVOUS DISEASES.

DERCUM. Rest, Suggestion, Mental Therapeutics. *See Cohen, Physiologic Therapeutics, page* 17.

GORDINIER. The Gross and Minute Anatomy of the Central Nervous System. With 271 original colored and other Illustrations. Cloth, $6.00; Sheep, $7.00

GOWERS. Syphilis and the Nervous System. $1.00

GOWERS. Manual of Diseases of the Nervous System. A Complete Text-Book. Revised, Enlarged, and in many parts Rewritten. With many new Illustrations. Two volumes.
Vol. I. Diseases of the Nerves and Spinal Cord. 3d Edition, Enlarged. Cloth, $4.00; Sheep, $5.00
Vol. II. Diseases of the Brain and Cranial Nerves; General and Functional Disease. 2d Ed. Cloth, $4.00; Sheep, $5.00

GOWERS. Epilepsy and Other Chronic Convulsive Diseases. 2d Edition. $3.00

HORSLEY. The Brain and Spinal Cord, the Structure and Functions of. Numerous Illustrations. $2.50

ORMEROD. Diseases of the Nervous System. 66 Wood Engravings. $1.00

PERSHING. Diagnosis of Nervous and Mental Diseases. Illustrated. $1.25

PRESTON. Hysteria and Certain Allied Conditions. Their Nature and Treatment. Illustrated. $2.00

WOOD. Brain Work and Overwork. .40

NURSING (see also Massage).

Special Catalogue of Books for Nurses sent free upon application.

CANFIELD. Hygiene of the Sick-Room. A Book for Nurses and Others. Being a Brief Consideration of Asepsis, Antisepsis, Disinfection, Bacteriology, Immunity, Heating and Ventilation, and Kindred Subjects for the Use of Nurses and Other Intelligent Women. $1.25

CUFF. Lectures to Nurses on Medicine. 4th Edition. $1.25

DAVIS. Bandaging. Its Principles and Practice. 163 Original Illustrations. $1.50

DOMVILLE. Manual for Nurses and Others Engaged in Attending the Sick. 9th Edition. With Recipes for Sick-room Cookery, etc. *In Press.*

FULLERTON. Obstetric Nursing. 5th Ed. 41 Illus. $1.00

FULLERTON. Surgical Nursing. 3d Ed. 69 Illus. $1.00

GROFF. Materia Medica for Nurses. With Questions for Self-Examination. 2d Edition, Revised and Improved. *Just Ready.* $1.25

HADLEY. General, Medical, and Surgical Nursing. A very Complete Manual, Including Sick-room Cookery. $1.25

HUMPHREY. A Manual for Nurses. Including General Anatomy and Physiology, Management of the Sick-room, etc. 24th Edition. 79 Illustrations. $1.00

STARR. The Hygiene of the Nursery. Including the General Regimen and Feeding of Infants and Children, and the Domestic Management of the Ordinary Emergencies of Early Life, Massage, etc. 6th Edition. 25 Illustrations. $1.00

TEMPERATURE AND CLINICAL CHARTS. See page 25.

VOSWINKEL. Surgical Nursing. Second Edition, Enlarged. 112 Illustrations. $1.00

WILCOX. Fever Nursing. *Preparing.*

OBSTETRICS.

CAZEAUX AND TARNIER. Midwifery. With Appendix by MUNDÉ. The Theory and Practice of Obstetrics, including the Diseases of Pregnancy and Parturition, Obstetrical Operations, etc. 8th Edition. Illustrated by colored and other full-page Plates, and numerous Wood Engravings. Cloth, $4.50; Full Leather, $5.50

EDGAR. Text-Book of Obstetrics. By J. CLIFTON EDGAR, M.D., Professor of Obstetrics and Clinical Midwifery, Medical Department of Cornell University, New York City, etc. 1221 Illustrations. *Just Ready.* Cloth, $6.00; Sheep, $7.00

FULLERTON. Obstetric Nursing. 5th Ed. Illus. $1.00

LANDIS. Compend of Obstetrics. 7th Edition, Revised by WM. H. WELLS, M.D., Demonstrator of Clinical Obstetrics, Jefferson Medical College. 52 Illustrations. .80; Interleaved, $1.00

WINCKEL. Text-Book of Obstetrics, Including the Pathology and Therapeutics of the Puerperal State. Illustrated. $5.00

PATHOLOGY.

BLACKBURN. Autopsies. A Manual of Autopsies Designed for the Use of Hospitals for the Insane and other Public Institutions. Ten full-page Plates and other Illustrations. $1.25

COPLIN. Manual of Pathology. Including Bacteriology, Technic of Post-Mortems, Methods of Pathologic Research, etc. 330 Illustrations, 7 Colored Plates. 3d Edition. $3.50

DA COSTA. Clinical Hematology. A Practical Guide to the Examination of the Blood. Six Colored Plates and 48 Illustrations. Cloth, $5.00; Sheep, $6.00

LAZARUS-BARLOW. Pathological Anatomy. With 7 Colored Plates and 171 other Illustrations. $6.50

MacLEOD. The Pathology of the Skin. Colored and other Illustrations. *Just Ready.* $5.00

MARTIN. Manual of Pathology. Illustrated. *Nearly Ready.*

ROBERTS. Gynecological Pathology. Illustrated. $6.00

THAYER. Compend of General Pathology. Illustrated. .80; Interleaved, $1.00

THAYER. Compend of Special Pathology. Illustrated. .80; Interleaved, $1.00

THAYER. Manual of General and Special Pathology. Illustrated. *Nearly Ready.*

VIRCHOW. Post-Mortem Examinations. 3d Edition. .75

WHITACRE. Laboratory Text-Book of Pathology. With 121 Illustrations. $1.50

PHARMACY.

Special Catalogue of Books on Pharmacy sent free upon application.

COBLENTZ. Manual of Pharmacy. A Complete Text-Book by the Professor in the New York College of Pharmacy. 2d Ed., Revised and Enlarged. 437 Illus. Cloth, $3.50; Sheep, $4.50

COBLENTZ. Volumetric Analysis. Illustrated. $1.25

BEASLEY. Book of 3100 Prescriptions. Collected from the Practice of the Most Eminent Physicians and Surgeons—English, French, and American. A Compendious History of the Materia Medica, Lists of the Doses of all the Officinal and Established Preparations, an Index of Diseases and their Remedies. 7th Edition. $2.00

BEASLEY. Druggists' General Receipt Book. Comprising a Copious Veterinary Formulary, Recipes in Patent and Proprietary Medicines, Druggists' Nostrums, etc.; Perfumery and Cosmetics, Beverages, Dietetic Articles and Condiments, Trade Chemicals, Scientific Processes, and many Useful Tables. 10th Edition. $2.00

BEASLEY. Pharmaceutical Formulary. A Synopsis of the British, French, German, and United States Pharmacopœias. Comprising Standard and Approved Formulæ for the Preparations and Compounds Employed in Medicine. 12th Ed. $2.00

GREENISH. Microscopical Examination of Foods and Drugs. Illustrated. *Just Ready.* $3.50

ROBINSON. Latin Grammar of Pharmacy and Medicine. 4th Edition. With elaborate Vocabularies. *Just Ready.* $1.50

SAYRE. Organic Materia Medica and Pharmacognosy. An Introduction to the Study of the Vegetable Kingdom and the Vegetable and Animal Drugs. Comprising the Botanical and Physical Characteristics, Source, Constituents, and Pharmacopeial Preparations, Insects Injurious to Drugs, and Pharmacal Botany. With sections on Histology and Microtechnique, by W. C. STEVENS. 374 Illustrations. Second Edition. Cloth, $4.50

SCOVILLE. The Art of Compounding. Second Edition, Revised and Enlarged. Cloth, $2.50

STEWART. Compend of Pharmacy. Based upon "Remington's Text-Book of Pharmacy." 5th Edition, Revised in Accordance with the U. S. Pharmacopœia, 1890. Complete Tables of Metric and English Weights and Measures. .80; Interleaved, $1.00

TAVERA. Medicinal Plants of the Philippines. $2.00

UNITED STATES PHARMACOPŒIA. 7th Decennial Revision. Cloth, $2.50 (postpaid, $2.77); Sheep, $3.00 (postpaid, $3.27); Interleaved, $4.00 (postpaid, $4.50); Printed on one side of page only, unbound, $3.50 (postpaid, $3.90).

Select Tables from the U. S. P. Being Nine of the Most Important and Useful Tables, Printed on Separate Sheets. .25

POTTER. Handbook of Materia Medica, Pharmacy, and Therapeutics. 600 Prescriptions. 9th Edition. Cloth, $5.00; Sheep, $6.00

PHYSIOLOGY.

BIRCH. Practical Physiology. An Elementary Class Book. 62 Illustrations. $1.75

BRUBAKER. Text-Book of Physiology. Illus. *Nearly Ready.*

BRUBAKER. Compend of Physiology. 11th Edition, Revised and Enlarged. Illustrated. .80; Interleaved, $1.00

JONES. Outlines of Physiology. 96 Illustrations. $1.50

KIRKES. Handbook of Physiology. 17th Authorized Edition. Revised, Rearranged, and Enlarged. By Prof. W. D. Halliburton, of Kings College, London. 681 Illustrations, some of which are in colors. Cloth, $3.00; Leather, $3.75

LANDOIS. A Text-Book of Human Physiology. Including Histology and Microscopical Anatomy, with Special Reference to the Requirements of Practical Medicine. 5th American, translated and edited from the last German Edition by A. P. Brubaker, M.D., and A. A. Eshner, M.D. *In Press.*

STARLING. Elements of Human Physiology. 100 Illus. $1.00

STIRLING. Outlines of Practical Physiology. Including Chemical and Experimental Physiology, with Special Reference to Practical Medicine. 3d Edition. 289 Illustrations. $2.00

TYSON. Cell Doctrine. Its History and Present State. $1.50

PRACTICE.

BEALE. On Slight Ailments: their Nature and Treatment. 2d Edition, Enlarged and Illustrated. $1.25

COHEN. Physiologic Therapeutics. The Treatment of Disease by Methods other than Drug-giving. *See page* 17.

FAGGE. Practice of Medicine. 4th Edition, by P. H. Pye-Smith, M.D. 2 volumes. Vol. I, $6.00; Vol. II, $6.00

FOWLER. Dictionary of Practical Medicine. By various writers. An Encyclopædia of Medicine. Cloth, $3.00; Half Morocco, $4.00

GOULD AND PYLE. Cyclopedia of Practical Medicine and Surgery. A Concise Reference Handbook, with particular Reference to Diagnosis and Treatment. Edited by DRS. GOULD and PYLE, Assisted by 72 Special Contributors. Illustrated, one volume. Large Square Octavo, Uniform with "Gould's Illustrated Dictionary."

Sheep or Half Mor., $10.00; with Thumb Index, $11.00
Half Russia, Thumb Index, $12.00

☞ *Complete descriptive circular free upon application.*

GOULD AND PYLE'S Pocket Cyclopedia of Medicine and Surgery. Based upon the above and Uniform with "Gould's Pocket Dictionary." Full Limp Leather, Gilt Edges, Round Corners, $1.00; with Thumb Index, $1.25.

HUGHES. Compend of the Practice of Medicine. 6th Edition, Revised and Enlarged.

Part I. Continued, Eruptive, and Periodical Fevers, Disease of the Stomach, Intestines, Peritoneum, Biliary Passages, Liver, Kidneys, etc., and General Diseases, etc.

Part II. Diseases of the Respiratory System, Circulatory System, and Nervous System; Diseases of the Blood, etc.

Price of each part, .80; Interleaved, $1.00

Physician's Edition. In one volume, including the above two parts, a Section on Skin Diseases, and an Index. 6th Revised Edition. 625 pp. Full Morocco, Gilt Edge, $2.25

TAYLOR. Practice of Medicine. 6th Edition. $4.00

TYSON. The Practice of Medicine. By JAMES TYSON, M.D. Professor of Medicine in the University of Pennsylvania. Complete Systematic Text-book, with Special Reference to Diagnosis and Treatment. 3d Edition, Enlarged and Revised. Colored Plates and 124 other Illustrations.

Cloth, $5.50; Leather, $6.50

STOMACH. INTESTINES.

FENWICK. Cancer of the Stomach. *Just Ready.* $3.00

HEMMETER. Diseases of the Stomach. Their Special Pathology, Diagnosis, and Treatment. With Sections on Anatomy, Analysis of Stomach Contents, Dietetics, Surgery of the Stomach, etc. 3d Edition, Revised. With 15 Plates and 41 other Illustrations, a number of which are in colors.

Cloth, $6.00; Sheep, $7.00

HEMMETER. Diseases of the Intestines. Their Special Pathology, Diagnosis, and Treatment. With Sections on Anatomy and Physiology, Microscopic and Chemic Examination of Intestinal Contents, Secretions, Feces and Urine, Intestinal Bacteria and Parasites, Surgery of the Intestines, Dietetics, Diseases of the Rectum, etc. With Full-page Colored Plates and many other Original Illustrations. 2 volumes. Octavo.

Price of each volume, Cloth, $5.00; Sheep, $6.00

SKIN.

BULKLEY. The Skin in Health and Disease. Illustrated. .40

CROCKER. Diseases of the Skin. Their Description, Pathology, Diagnosis, and Treatment, with Special Reference to the Skin Eruptions of Children. 3d Edition, Thoroughly Revised. With New Illus. *Just Ready.* Cloth, $5.00; Sheep, $6.00

MacLEOD. The Pathology of the Skin. Colored and other Illustrations. *Just Ready.* $5.00

SCHAMBERG. Diseases of the Skin. 3d Edition, Revised and Enlarged. 106 Illustrations. Being No. 16 ? Quiz-Compend? Series. *Just Ready.* Cloth, .80; Interleaved, $1.00

VAN HARLINGEN. On Skin Diseases. A Practical Manual of Diagnosis and Treatment, with Special Reference to Differential Diagnosis. 3d Edition, Revised and Enlarged. With Formulæ and 60 Illustrations, some of which are printed in colors. $2.75

SURGERY AND SURGICAL DISEASES
(see also Urinary Organs).

BERRY. Diseases of the Thyroid Gland. Illustrated. $4.00

BUTLIN. Operative Surgery of Malignant Disease. 2d Edition. Illustrated. Octavo. $4.50

CASPER AND RICHTER. Functional Kidney Diagnosis. $1.50

DAVIS. Bandaging. Its Principles and Practice. 163 Original Illustrations. $1.50

DEAVER. Surgical Anatomy. A Treatise on Human Anatomy in its Application to Medicine and Surgery. With about 500 very handsome full-page Illustrations Engraved from Original Drawings made by special Artists from Dissections prepared for the purpose. Three volumes. Royal Square Octavo. By *Subscription only. Now Ready.*
Half Morocco or Sheep, $24.00; Half Russia, $27.00

DEAVER. Appendicitis: its Symptoms, Diagnosis, Pathology, Treatment, and Complications. Elaborately Illustrated with Colored Plates and other Illus. 3d Edition. *Preparing.*

DOUGLAS. Surgical Diseases of the Abdomen. Illustrated by 20 Full-page Plates. *Just Ready.*
Cloth, $7.00; Sheep, $8.00

DULLES. What to do First in Accidents and Poisoning. 5th Edition. New Illustrations. $1.00

FULLERTON. Surgical Nursing. 3d Ed. 69 Illus. $1.00

HAMILTON. Lectures on Tumors. 3d Edition. $1.25

HEATH. Minor Surgery and Bandaging. 12th Edition, Revised and Enlarged. 195 Illus., Formulæ, Diet List, etc. $1.50

HEATH. Clinical Lectures on Surgical Subjects. Second Series. $2.00

HORWITZ. Compend of Surgery and Bandaging. Including Minor Surgery, Amputations, Fractures, Dislocations, Surgical Diseases, etc., with Differential Diagnosis and Treatment. 5th Edition, very much Enlarged and Rearranged. 167 Illus., 98 Formulæ. Cloth, .80; Interleaved, $1.00

JACOBSON. Operations of Surgery. 4th Ed., Enlarged. 550 Illus. Two volumes. Cloth, $10.00; Leather, $12.00

KEAY. Medical Treatment of Gall-Stones. $1.25

KEHR. Gall-stone Disease. Translated by WILLIAM WOTKYNS SEYMOUR, M.D. $2.50

MAKINS. Surgical Experiences in South Africa. 1899–1900. Illustrated. $4.00

MAYLARD. Surgery of the Alimentary Canal. 97 Illustrations. 2d Edition, Revised. $3.00

MOULLIN. Text-Book of Surgery. With Special Reference to Treatment. 3d American Edition. Revised and edited by JOHN B. HAMILTON, M.D., LL.D., Professor of the Principles of Surgery and Clinical Surgery, Rush Medical College, Chicago. 623 Illustrations, many of which are printed in colors.
Cloth, $6.00; Leather, $7.00

SMITH. Abdominal Surgery. Being a Systematic Description of all the Principal Operations. 224 Illustrations. 6th Edition. 2 volumes. Cloth, $10.00

VOSWINKEL. Surgical Nursing. Second Edition, Revised and Enlarged. 111 Illustrations. $1.00

WALSHAM. Manual of Practical Surgery. 7th Ed., Revised and Enlarged. 483 Engravings. 950 pages. $3.50

TEMPERATURE CHARTS, ETC.

GRIFFITH. Graphic Clinical Chart for Recording Temperature, Respiration, Pulse, Day of Disease, Date, Age, Sex, Occupation, Name, etc. Printed in three colors. Sample copies free. Put up in loose packages of fifty, 50 cts. Price to Hospitals, 500 copies, $4.00; 1000 copies, $7.50.

KEEN'S Clinical Charts. Seven Outline Drawings of the Body, on which may be marked the Course of Disease, Fractures, Operations, etc. Each Drawing may be had separately, twenty-five to pad, 25 cents.

THROAT AND NOSE (see also Ear).

COHEN. The Throat and Voice. Illustrated. .40

HALL. Diseases of the Nose and Throat. 2d Edition, Enlarged. Two Colored Plates and 80 Illustrations. $2.75

HOLLOPETER. Hay Fever. Its Successful Treatment. $1.00

KNIGHT. Diseases of the Throat. A Manual for Students. Illustrated. *Nearly Ready.*

KYLE (J. J.). Diseases of the Ear, Nose, and Throat. A Compend for Students. Illustrated. .80; Interleaved, $1.00

McBRIDE. Diseases of the Throat, Nose, and Ear. With Colored Illustrations from Original Drawings. 3d Ed. $7.00

POTTER. Speech and its Defects. Considered Physiologically, Pathologically, and Remedially. $1.00

URINE AND URINARY ORGANS.

ACTON. The Functions and Disorders of the Reproductive Organs in Childhood, Youth, Adult Age, and Advanced Life, Considered in their Physiological, Social, and Moral Relations. 8th Edition. $1.75

CASPER AND RICHTER. Functional Kidney Diagnosis. $1.50

HOLLAND. The Urine, the Gastric Contents, the Common Poisons, and the Milk. Memoranda, Chemical and Microscopical, for Laboratory Use. Illustrated and Interleaved. 6th Edition. $1.00

KLEEN. Diabetes and Glycosuria. $2.50

MEMMINGER. Diagnosis by the Urine. 2d Edition. 24 Illustrations. $1.00

MORRIS. Renal Surgery, with Special Reference to Stone in the Kidney and Ureter and to the Surgical Treatment of Calculous Anuria. Illustrated. $2.00

MOULLIN. Enlargement of the Prostate. Its Treatment and Radical Cure. 2d Edition. Illustrated. $1.75

MOULLIN. Inflammation of the Bladder and Urinary Fever. Octavo. $1.50

SCOTT. The Urine. Its Clinical and Microscopical Examination. 41 Lithographic Plates and other Illustrations. Quarto. Cloth, $5.00

TYSON. Guide to Examination of the Urine. For the Use of Physicians and Students. With Colored Plate and Numerous Illustrations engraved on wood. 10th Edition, Revised, Enlarged, and partly Rewritten. With New Illustrations. *Just Ready.* $1.50

VAN NUYS. Chemical Analysis of Urine. 39 Illus. $1.00

VENEREAL DISEASES.

GOWERS. Syphilis and the Nervous System. $1.00

STURGIS AND CABOT. Student's Manual of Venereal Diseases. 7th Revised and Enlarged Edition. 12mo. $1.25

VETERINARY.

BALLOU. Equine Anatomy and Physiology. 29 Graphic Illustrations. .80; Interleaved, $1.00

JACOBSON. The Operations of Surgery. By W. H. A. JACOBSON, F.R.C.S., Surgeon to Guy's Hospital; Consulting Surgeon Royal Hospital for Children and Women; and F. J. STEWARD, F.R.C.S., Assistant Surgeon Guy's Hospital. Fourth Edition—Revised, Enlarged, and Improved. 550 Illustrations. Two Volumes, Octavo, 1524 pages.

Cloth, $10.00; Sheep, $12.00

"The important anatomical points are clearly set forth, the conditions indicating or contraindicating operative interference are given, the details of the operations themselves are brought forward prominently, and frequently the after-treatment is considered. Herein is one of the strong points of the book."—*New York Medical Journal.*

"We know of no series of books issued by any house that so fully meets our approval as these ? Quiz-Compends?. They are well arranged, full and concise, and are really the best line of text-books that could be found for either student or practitioner." —*Southern Clinic.*

BLAKISTON'S ?QUIZ-COMPENDS?

The Best Series of Manuals for the Use of Students.

Price of each, Cloth, .80. Interleaved, for taking Notes, $1.00

These Compends are based on the most popular text-books and the lectures of prominent professors, and are kept constantly revised, so that they may thoroughly represent the present state of the subjects upon which they treat. The authors have had large experience as Quiz-Masters and attaches of colleges, and are well acquainted with the wants of students. They are arranged in the most approved form, thorough and concise, containing nearly 1000 illustrations and lithograph plates, inserted wherever they could be used to advantage. Can be used by students of *any* college. They contain information nowhere else collected in such a condensed, practical shape.

No. 1. POTTER. HUMAN ANATOMY. Seventh Edition. 138 Illustrations and 16 Plates of Nerves and Arteries.

No. 2. HUGHES. PRACTICE OF MEDICINE. Part I. Sixth Edition, Enlarged and Improved.

No. 3. HUGHES. PRACTICE OF MEDICINE. Part II. Sixth Edition, Revised and Improved.

No. 4. BRUBAKER. PHYSIOLOGY. Eleventh Edition. Illus.

No. 5. LANDIS. OBSTETRICS. Seventh Edition. 52 Illus.

No. 6. POTTER. MATERIA MEDICA, THERAPEUTICS, AND PRESCRIPTION WRITING. Sixth Revised Edition.

No. 7. WELLS. GYNECOLOGY. Third Edition. 140 Illus.

No. 8. GOULD AND PYLE. DISEASES OF THE EYE. Second Edition. Refraction, Treatment, Surgery, etc. 109 Illus.

No. 9. HORWITZ. SURGERY. Including Minor Surgery, Bandaging, Surgical Diseases, Differential Diagnosis and Treatment. Fifth Edition. With 98 Formulæ and 71 Illustrations.

No. 10. LEFFMANN. MEDICAL CHEMISTRY. Fourth Edition. Including Urinalysis, Animal Chemistry, Chemistry of Milk, Blood, Tissues, the Secretions, etc.

No. 11. STEWART. PHARMACY. Fifth Edition. Based upon Prof. Remington's Text-Book of Pharmacy.

No. 12. BALLOU. EQUINE ANATOMY AND PHYSIOLOGY. 29 graphic Illustrations.

No. 13. WARREN. DENTAL PATHOLOGY AND DENTAL MEDICINE. Third Edition, Illustrated.

No. 14. HATFIELD. DISEASES OF CHILDREN. 3d Edition.

No. 15. THAYER. GENERAL PATHOLOGY. 78 Illus.

No. 16. SCHAMBERG. DISEASES OF THE SKIN. Third Edition, Revised and Enlarged. 106 Illustrations.

No. 17. CUSHING. HISTOLOGY. Illustrated. *In Press.*

No. 18. THAYER. SPECIAL PATHOLOGY. 34 Illustrations.

No. 19. KYLE. DISEASES OF THE EAR, NOSE, AND THROAT. Illustrated.

DA COSTA

Clinical Hematology

A Practical Guide to the Examination of the Blood by Clinical Methods. With Reference to the Diagnosis of Disease. With Colored Illustrations. Cloth, $5.00

*** A new, thorough, systematic, and comprehensive work, its purpose being, first, to show how to examine the blood, and second, how to diagnose from such examination diseases of the blood itself and general diseases. The author's aim has been to cover not alone the field of original research, but to supply a book for the student, the hospital physician and the general practitioner. It will be found wanting in none of these respects.

OERTEL

Medical Microscopy

JUST READY

A GUIDE TO DIAGNOSIS, ELEMENTARY LABORATORY METHODS, AND MICROSCOPIC TECHNIC

By T. E. Oertel, M.D.,

Professor of Pathology and Clinical Microscopy, Medical Department, University of Georgia.

WITH 131 ILLUSTRATIONS. 12mo. Cloth, $2.00

The Pocket Cyclopedia of Medicine and Surgery

Full Limp Leather, Round Corners, Gilt Edges, $1.00
With Thumb Index, $1.25

Uniform with "Gould's Pocket Dictionary"

A concise practical volume of nearly 600 pages, containing a vast amount of information on all medical subjects, including Diagnosis and Treatment of Disease, with Formulas and Prescriptions, Emergencies, Poisons, Drugs and Their Uses, Nursing, Surgical Procedures, Dose List in both English and Metric Systems, etc.

By Drs. Gould and Pyle

Based upon their large "Cyclopedia of Medicine and Surgery."

*** This is a new book which will prove of the greatest value to students. It is to the broad field of general medical information what "Gould's Pocket Dictionary" is to the more special one of definition and pronunciation of words. The articles are concise but thorough, and arranged in shape for quick reference. In no other book can be found so much exact detailed knowledge so conveniently classified, so evenly distributed, so methodically grouped. It is *Multum in Parvo.* **Sample Pages Free.**

A NEW EDITION

CROCKER ON THE SKIN

The Diseases of the Skin. Their Description, Pathology, Diagnosis, and Treatment, with Special Reference to the Skin Eruptions of Children. By H. RADCLIFFE CROCKER, M.D., Physician to the Department of Skin Diseases, University College Hospital, London. With new Illustrations.

Third Edition, Rewritten and Enlarged

OCTAVO. JUST READY; CLOTH, $5.00

*** This new edition will easily hold the high position given the previous printings. The author is a member of American, English, French, German, and Italian Dermatological Societies, and a recognized authority the world over.

STURGIS—MANUAL OF VENEREAL DISEASES

By F. R. STURGIS, M.D., Sometime Clinical Professor of Venereal Diseases in the Medical Department of the University of the City of New York. Seventh Edition, Revised and in Part Rewritten by the Author and FOLLEN CABOT, M.D., Instructor in Genito-Urinary and Venereal Diseases in the Cornell University Medical College. 12mo. 216 pages. Cloth, $1.25

*** This manual was originally written for students' use, and is as concise and as practical as possible. It presents a careful, condensed description of the commoner forms of venereal diseases which occur in the practice of the general physician, together with the most approved remedies.

FOR THE DISSECTING ROOM

Holden's Anatomy—Seventh Edition
320 Illustrations

A Manual of the Dissections of the Human Body. By JOHN LANGTON, F.R.C.S. Carefully Revised by A. HEWSON, M.D., Demonstrator of Anatomy, Jefferson Medical College, Philadelphia, etc. 320 Illustrations. Two small compact volumes. 12mo.

Vol. I. Scalp, Face, Orbit, Neck, Throat, Thorax, Upper Extremity. · 435 pages. 153 Illustrations.
Oil Cloth, $1.50

Vol. II. Abdomen, Perineum, Lower Extremity, Brain, Eye, Ear, Mammary Gland, Scrotum, Testes. 445 pages. 167 Illustrations.
Oil Cloth, $1.50

Each volume sold separately.

Hughes and Keith—Dissections Illustrated

A Manual of Dissections by ALFRED W. HUGHES, M.B., M.R.C.S. (Edin.), late Professor of Anatomy and Dean of Medical Faculty, King's College, London, etc., and ARTHUR KEITH, M.D., Joint Lecturer on Anatomy, London Hospital Medical College, etc. In three parts. With 527 Colored and other Illustrations.

I. Upper and Lower Extremity. 38 Plates, 116 other Illustrations. Cloth, $3.00

II. Abdomen. Thorax. 4 Plates, 149 other Illustrations. Cloth, $3.00

III. Head, Neck, and Central Nervous System. 16 Plates, 204 other Illustrations. Cloth, $3.00

Each volume sold separately.

*** The student will find it of great advantage to have a "Dissector" to supplement his regular text-book on anatomy. These books meet all requirements, and as they can be purchased in parts as wanted, the outlay is small.

EDGAR'S

OBSTETRICS

A NEW TEXT-BOOK

1221 Illustrations

Edgar's Obstetrics excels all other works on this subject in completeness, in uniformity and consistency in arrangement, thoroughness and clearness in handling details, and in the number and usefulness of its illustrations.

OCTAVO. CLOTH, $6.00; SHEEP, $7.00

Continued from front cover.

Galvanoscope. An instrument for detecting the direction and presence of a galvanic current.

General Electrization. The application of electricity to all parts of the surface of the body during a treatment.

Gravity Batteries. Galvanic cells in which the elements are placed horizontally, and the two fluids are kept separate by difference in density.

Hydro-Electrization. Electricity applied by means of water as an electrode.

Hydrostat. A device for preventing the spilling of fluid out of battery cells.

IONS. Elements into which a substance is divided by electrolysis.

Induced Charge. When a charged body is brought near another, but not in contact with it, the latter becomes electrified or possesses an induced charge.

Induction. The process of exciting electricity in any object by bringing it near to, but not in contact with, a circuit through which a current is passing.

Induction Coil. This refers to the coarse wire coil through which the primary current passes.

Initial Charge. A charge excited on glass or rubber and conveyed to the plates of a static machine by contact.

Insulators. Substances which hinder the passage of electricity.

Insulation. Supporting or surrounding a body by an insulator.

Intensity. The energy or effectiveness with which electricity acts.

Interrupted Current. A current that is alternately opened and closed.

Inverse Current. Ascending or centripetal current.

LABILE CURRENT. Moving one or both electrodes over the surface treated.

Latent Electricity. Passive, bound, or natural electricity.

Leyden Jar. The ordinary form consists of a glass jar or bottle with an outside and inside coating of metal reaching within two to four inches of the top, an insulating cap fitting into the neck of the jar supporting a brass rod terminating above in a knob, and below in a strip of foil or chain that lies upon the inner metallic coating on the bottom of the jar.

Lines of Magnetic Force. The curved lines through which the force emanating from a magnet acts.

Magnet. A bar of steel or iron to which the peculiar properties of the lodestone have been imparted.

Magnetic Axis. The line joining the poles of a magnet.

Magnetic Field. Any region within the influence of a magnet.

Magnetize. To communicate magnetic properties to substances that do not exhibit them.

Magneto-Electricity. Electricity generated or set free by the action of a magnet.

Micro-Farad. Practical unit of capacity. A condenser of one micro-farad capacity would contain about 300 circular sheets of tinfoil separated by mica plates, and would be contained in a box 3¼ inches deep and 6½ inches in diameter.

Molecule. The smallest quantity that can exist in a free state.

Motor-Points. The points on the surface of the body where the various branches of the motor nerves supplying the muscles may be affected by electricity.

Multiplier. A coil of wire through which a galvanic current is passed to increase or multiply its effect upon a magnetic needle placed above it.

Negative Electricity. Originally referred to that form of electricity developed by rubbing sealing-wax. Electricity from any plate, condenser or element which affects the electroscope in the same way as sealing-wax is called negative.

Negative Element. That portion of the carbon, copper or platinum element immersed in the fluid is electro-negative. The zinc, from which negative electricity is obtained, is, however, usually spoken of as the *negative* element.

Non-Electric. Those substances which permit electricity excited on them by friction to escape as fast as formed.

OHM. The unit of resistance. About equal to the resistance of a cylindrical wire of pure copper 250 feet in length, having a diameter of 1-20 of an inch.

Ohm's Law. The law devised by Ohm for determining the current generated and the amount of work it can do under given conditions, when the force of the battery and the resistance of the circuit are known.

Opening Contractions. Muscular contractions produced by opening or breaking the circuit.

Oxidation. The rust collected upon the metal parts of a battery.

Para-Magnetic Bodies. Bodies attracted by the magnet.

Peripheral Electrization. Electricity applied to the external surface of the body.

Phreno-Magnetism. Excitement of the organs of the brain by mesmeric passes.

Pile. The name given to a pile composed of disks of zinc and copper separated by a moist, porous material. Frequently applied to the combination of elements in battery cells.

Polar. Relating to the poles.

Polar Force. That force with which similar ends of magnets attract, and dissimilar repel each other.

Polarity of Nerves. That condition of a nerve in which the part nearest the negative pole is in a state of increased, and that nearest the positive is in a state of diminished, irritability.

Polar Method. This is accomplished by placing the pole whose distinctive effect is wanted, over the part to be treated, and the other pole over some indifferent part.

Polarization. The act of forming poles or points of intensity having qualities mutually opposite.

Pole Changer. A device for changing the direction of the current without removing the electrodes.

Poles, Electric. Points where electricity passes in and out.

Positive Electricity. That which is set free by rubbing glass with silk.

Positive Pole. The binding post, conducting cord and electrode connected with the carbon, copper or platinum (electro-negative) element of the battery.

Potential. This term holds the same relation to electricity that the term level does to gravity. Just as water at a higher level tends to flow to a lower one, so electricity at a higher potential tends to move to a point of lower potential. It is often used synonymously with tension, but since the latter term is used to express very diverse conditions, electricians now make use of the term potential in referring to "electric level," whether static, dynamic or magnetic.

Potential (Dynamic). Difference of "electric level" between two elements, when both are immersed in the same fluid, which acts chemically upon one of them. The same term applies to difference in electric level produced by revolving coils of wire between the poles of horseshoe magnets.

Primary Coil. The layers of coarse wire which form the inner coil of the helix.

Primary Current. The inducing current from the primary coil.

Quantity. The amount of electricity generated in a given time.

RADICALS. The *ions* or elementary atoms into which a chemical compound is divided by electrolysis.

Resinous Electricity. That which is excited by rubbing wax or resin with flannel.

Reverser (Current). Pole changer.

Rheochord. A metallic wire introduced into a circuit to vary the strength of the current.

Rheometer. Galvanometer.

Rheomotor. The apparatus by which an electrical current is originated.

Rheophore. An electrode.

Rheoscope. A galvanoscope.

Rheostat. An instrument for bringing a definite amount of resistance into the circuit.

Rheotome. A current breaker.

Rotary Machine. Magnetic-Electric Machines in which electricity is generated by turning a crank.

Ruhmkoff Coil. A very powerful induction coil invented by Ruhmkoff.

Secondary Battery. A storage battery.

Secondary Coil. A coil of fine wire wound in many layers around the primary coil from which it is separated by insulation.

Secondary Current. The induced current from the secondary coil. The faradic current.

Sensibility, Electro-Muscular. The peculiar sensation produced on a muscle contracted by electricity.

Shield. The tube or sheath which answers the purpose of a current regulator.

Shock. A sudden discharge of electricity. The impression made on the nerves by opening or closing the circuit or increasing its strength.

Short Circuit. A circuit completed before reaching the conductors or electrodes.

Stabile Current. A current applied with both electrodes in a fixed position.

Statical Electricity. Electricity at rest.

Switch. Metallic bars revolving on a pivot, used to connect sections of cells, as current reversers, and current selectors. They form a part of the battery accessories that are attached to the base.

Tension. The tendency of electricity to overcome resistance. The strain put upon the circuit by the electro-motive force.

Tetanization. The production of a contracted condition in a nerve by an electric current.

Thermo-Electricity. Electricity that is generated when two metals are soldered together so as to form a closed circuit, and one of the junctions is heated more than the other.

To and Fro Current. Faradic current.

Tray Cell. A gravity cell, named from its shape.

Trembler. The vibrator.

Two-Fluid Cell. A cell in which a different fluid is used with each element.

Uninterrupted Current. The galvanic current.

Unit of Current. An ampere.

Unit of Force. One volt.

Unit of Resistance. The ohm.

Unpolarized Electrodes. Electrodes made of pure amalgamated zinc.

VITREOUS ELECTRICITY. That excited by friction of glass.

Volt. A unit of electro-motive force.

Voltaic Alternatives. When a pole changer is introduced into the circuit so as to break not only the circuit, but change the direction of the current at every break, the method has been named voltaic alternatives.

Voltameter. An apparatus for measuring the strength of a galvanic current.